



Biological Assessment Report

Hinkson Creek Macroinvertebrate Community Assessment Year 4: Spring & Fall 2015

Boone County, Missouri

Prepared for:

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Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

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Attachments

- Appendix A Spring 2015 Macroinvertebrate Taxa Lists, Hinkson Creek and Bonne Femme Creek
- Fall 2015 Macroinvertebrate Taxa Lists, Hinkson Creek and Bonne Femme Creek
- Appendix B Hinkson Creek and Bonne Femme Creek Water Quality Parameter Values
- Appendix C Biological Metric Values Fall 2001-Fall 2014: Taxa Richness; EPT Taxa; Biotic Index; Shannon Diversity Index (shaded cells indicate values that are less than the fully supporting threshold).
- Appendix D SigmaStat[®] Statistical Analysis Results of Hinkson Creek Mean Biological Metric Values Comparing Pre-CAM (2001-2006) Sample Data with CAM Project Data (2012-2015).

1.0 Introduction

In 1998 the Missouri Department of Natural Resources (**Department**) placed approximately 14 miles of Hinkson Creek (**HC**) on its list of impaired waters designated under Section 303(d) of the Clean Water Act. In the Total Maximum Daily Load (**TMDL**) document prepared for this watershed, the pollutant(s) causing the impairment were listed as unknown, and the sources of this pollution were listed as “urban runoff” and “urban nonpoint source” (United States Environmental Protection Agency [**USEPA**] 2011). As an alternative to the strict adherence to the requirements outlined in the TMDL, a Collaborative Adaptive Management (**CAM**) plan was developed among the stakeholders that included the city of Columbia, Boone County, the University of Missouri-Columbia, Region VII of the USEPA, the Department, and other entities. The decision to undertake a multi-year biological assessment as part of the CAM process was, in part, to gauge the effects of improved infrastructure (e.g. wastewater collection improvements and closure of municipal or subdivision lagoons) in the Hinkson Creek watershed since the conclusion of the three-phase water quality assessment in 2006 (MoDNR 2004, 2005, 2006). This report includes the assessment of data collected during 2015, the fourth year of a six-year biological study of HC.

The biological, chemical, and physical conditions of HC have been studied extensively and have documented various effects of stream degradation (e.g. Tarr 1924; Parris 2000, MoDNR 2002, 2004, 2005, 2006; Nichols 2012; Hooper 2015). Numerous studies also have investigated the hydrogeological character of HC and its watershed (e.g. several studies published by Dr. Jason Hubbart, former professor with the University of Missouri-Columbia). Combined, these disciplines demonstrate that HC is a complex system with several potential factors contributing to periodic biological impairment that has been documented in past bioassessment studies. No single factor or set of factors, however, has been identified as the primary cause(s) of HC impairment.

2.0 Study Area

HC is considered a Missouri Ozark border stream and is in the transitional zone between the Glaciated Plains to the north and the Ozark Highlands to the south (Thom and Wilson 1980). It is located in the Ozark/Moreau/Loutre ecological drainage unit (**EDU**). Thus, its bioassessment results were compared to reference streams considered to represent the best attainable biological conditions of this EDU.

In this study, the biological conditions of HC also were compared to those of Bonne Femme Creek (**BFC**). This stream is more similar in size to HC than the larger Ozark/Moreau/Loutre EDU biocriteria reference streams, and its watershed size is similar in area to the middle and upper segments of HC but with minimal urbanization. BFC originates southeast of Columbia in Boone County and flows in a southwesterly direction to its entrance into the Missouri River (Figure 1). Within the study area (Figure 2), it is classified as a permanent stream. Land use in its approximately 51-square-mile watershed is 3% urban, 22% cropland, 34% grassland, and 36% forest (MoRAP 2005).

The geographical relationship of HC, BFC, and their locations relative to the city of Columbia are illustrated in Figure 1. HC originates northeast of Hallsville in Boone County and flows approximately 26 miles in a southwesterly direction to its entrance into Perche Creek (Figure 1). It is classified as a permanent stream for the lower six miles and intermittent upstream of the Highway 163 (Providence Road) crossing.

In addition to flow status, the HC watershed is bisected by Interstate 70, which marks a change in land use (Figure 3). Upstream of Interstate 70 land use is primarily agriculture with smaller areas of residential and commercial development; downstream of the interstate is more urban. Land use in the approximately 89-square-mile watershed is 20.7% urban, 11.5% cropland, 38.2% grassland, and 26.9% forest, with the remainder consisting of open water and barren surfaces (MoRAP 2005).

3.0 Site Descriptions

All of the following sample sites were in Boone County, Missouri (Figures 2 and 3).

HC Station #1 (SE ¼ sec. 29, T. 48 N., R. 13 W.) was located downstream of the Scott Boulevard bridge. Geographic coordinates at the upstream terminus of the station were UTME 551970, UTMN 4307414.

HC Station #2 (NW ¼ sec. 27, T. 48 N., R. 13 W.) was located upstream of the MKT Trail bridge in the vicinity of Twin Lakes Recreational Area. Geographic coordinates at the upstream terminus of this station were UTME 553966, UTMN 4308301.

HC Station #3 (NE ¼ sec. 27, T. 48 N., R. 13 W.) was located downstream of the Forum Boulevard bridge. Geographic coordinates of the upstream terminus of the station were UTME 555061, UTMN 4308249.

HC Station #3.5 (SW ¼ sec. 24, T. 48 N., R. 13 W.) was located upstream of the Recreation Drive culvert crossing (just east of Providence Road). Geographic coordinates of the downstream terminus of the station were UTME 557571, UTMN 4309043.

HC Station #4 (NW ¼ sec. 19, T. 48 N., R. 12 W.) was located downstream of the Rock Quarry Road bridge. Geographic coordinates of the downstream terminus of the station were UTME 558533, UTMN 4309388.

HC Station #5 (NW ¼ sec. 19 T. 48 N., R. 12 W.) was located upstream of the most upstream footbridge of Capen Park. Geographic coordinates of the upstream terminus of the station were UTME 559135, UTMN 4309518.

HC Station #5.5 (NE ¼ sec. 18, T. 48 N., R. 12 W.) was located downstream of the Green Valley Drive bridge (just south of Broadway Street). Geographic coordinates of the upstream terminus of the station were UTME 560081, UTMN 4311180.

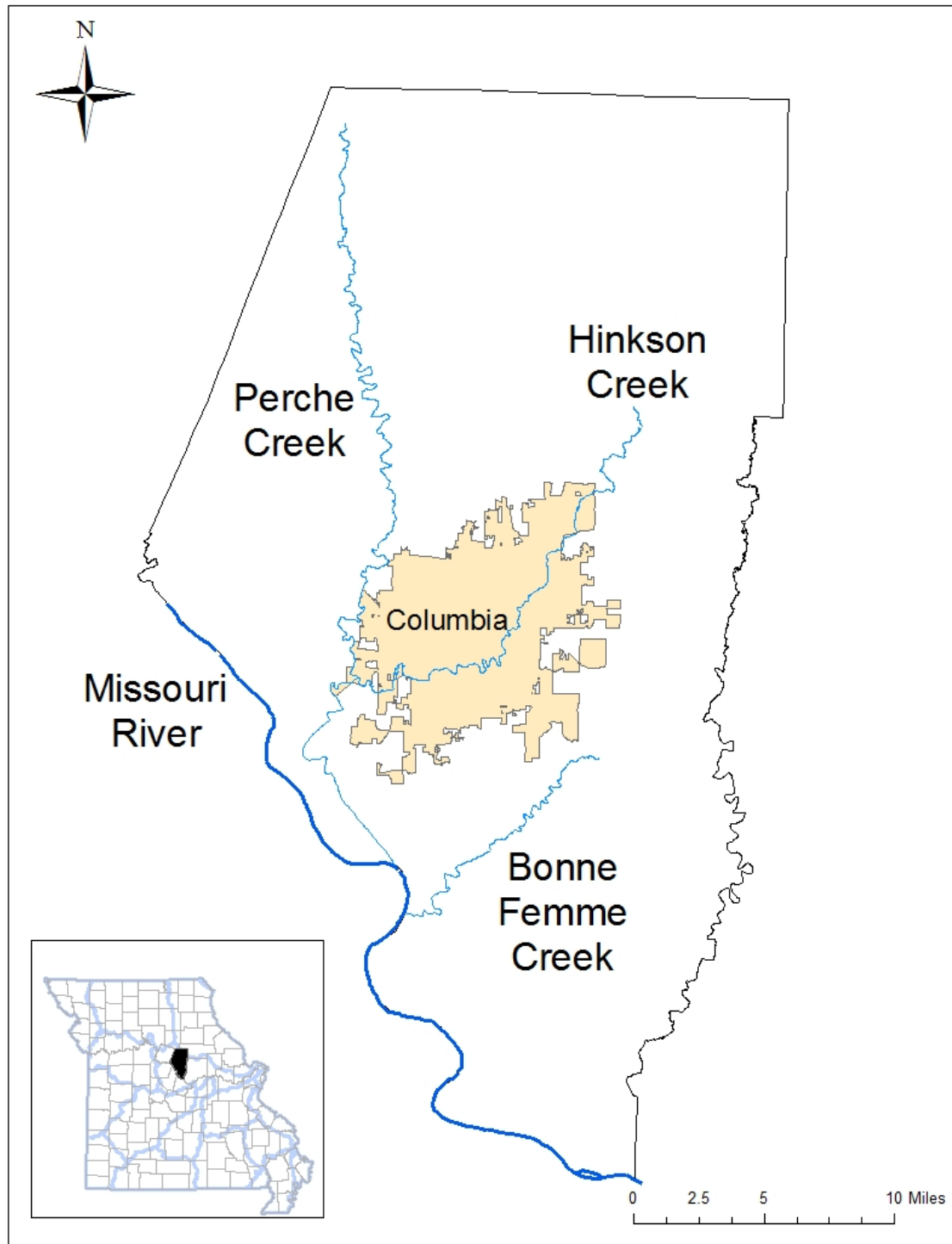


Figure 1. Boone County, Missouri, including the overall study area.

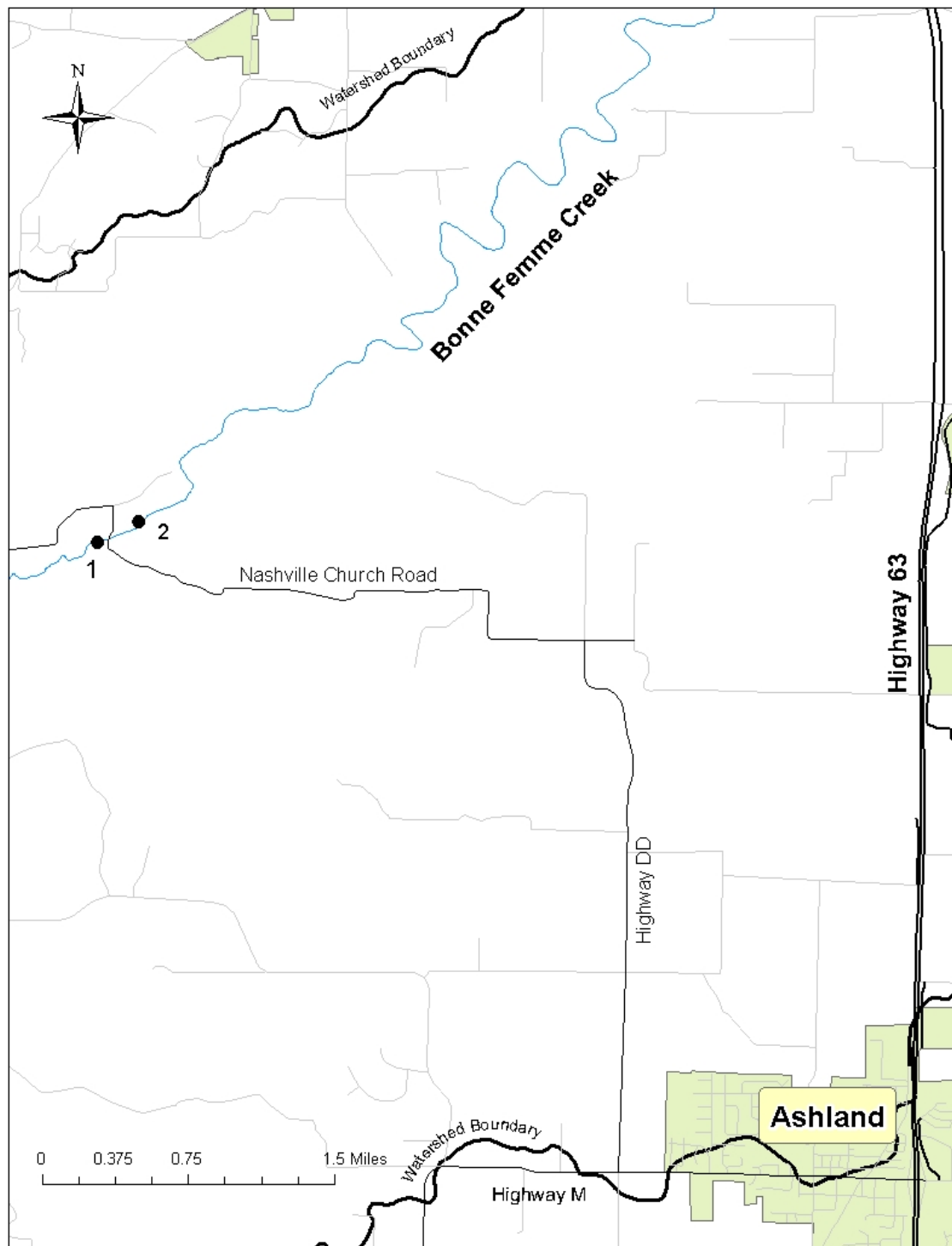


Figure 2. Bonne Femme Creek sampling stations for the 2015 study.

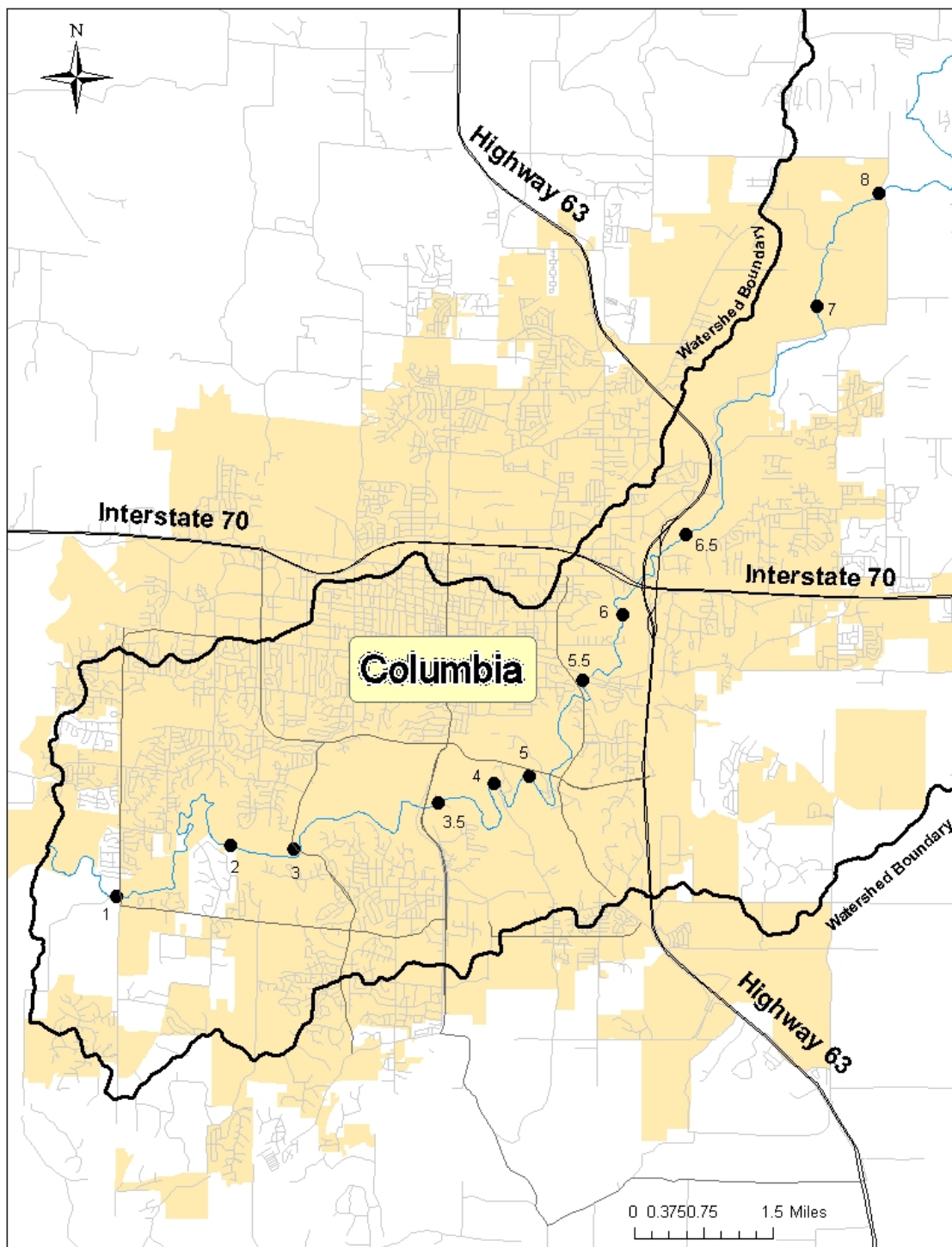


Figure 3. Hinkson Creek sampling stations for the 2015 study.

HC Station #6 (SW $\frac{1}{4}$ sec. 8, T. 48 N., R. 12 W.) was located in the vicinity of the East Walnut Street bridge. Geographic coordinates near the upstream terminus of the station were UTME 560767, UTMN 4312309.

HC Station #6.5 (SE $\frac{1}{4}$ sec. 5, T. 48 N., R. 12 W.) was located upstream of the Highway 63 connector (upstream of the trailer park east of the connector and behind Home Depot). Geographic coordinates in the downstream portion of the station were UTME 561861, UTMN 4313714.

HC Station #7 (NW $\frac{1}{4}$ sec. 27, T. 49 N., R. 12 W.) was located upstream of the Hinkson Creek Road/Wyatt Lane bridge. Geographic coordinates at the upstream terminus of the station were UTME 564140, UTMN 4317670.

HC Station #8 (SE $\frac{1}{4}$ sec. 15, T. 49 N., R. 12 W.) was located downstream of the Rogers Road bridge. Geographic coordinates at the downstream terminus of the station were UTME 565212, UTMN 4319627.

BFC Station #1 (SE $\frac{1}{4}$ sec. 25, T. 47 N., R. 13 W.) was located downstream of the Nashville Church Road bridge (Figure 2). Geographic coordinates at the upstream terminus of the station were UTME 558176, UTMN 4297283.

BFC Station #2 (SW $\frac{1}{4}$ sec. 30, T. 47 N., R. 12 W.) was located upstream of the Nashville Church Road bridge. Geographic coordinates at the downstream terminus of the station were UTME 558519, UTMN 4297449.

4.0 Methods

4.1 Macroinvertebrate Collection and Analyses

Spring samples for this study were collected four days after a moderate high water event (Figure 4). At the time of sampling, the creek was slightly elevated and turbid, but conditions did not hinder sample collection. HC stations were sampled on March 30-31, 2015, and BFC was sampled on April 1, 2015. Macroinvertebrate spring samples were collected by Raissa Espejo, Carl Wakefield, and Dave Michaelson. Mike Irwin collected water chemistry grab samples. Fall samples were collected from HC Stations 1-6.5 on September 29-30, 2015. HC Stations 7 and 8 were not sampled due to lack of flow at these two upstream sites. BFC samples were collected on October 1, 2015. Although the fall 2015 USGS gaging station graph appears to show considerable variability (Figure 5), it provides an overall visual representation of flow conditions at the time of sampling. Macroinvertebrate fall samples were collected by Brandy Bergthold, Brian Nodine, and Dave Michaelson. Carl Wakefield collected water chemistry grab samples.

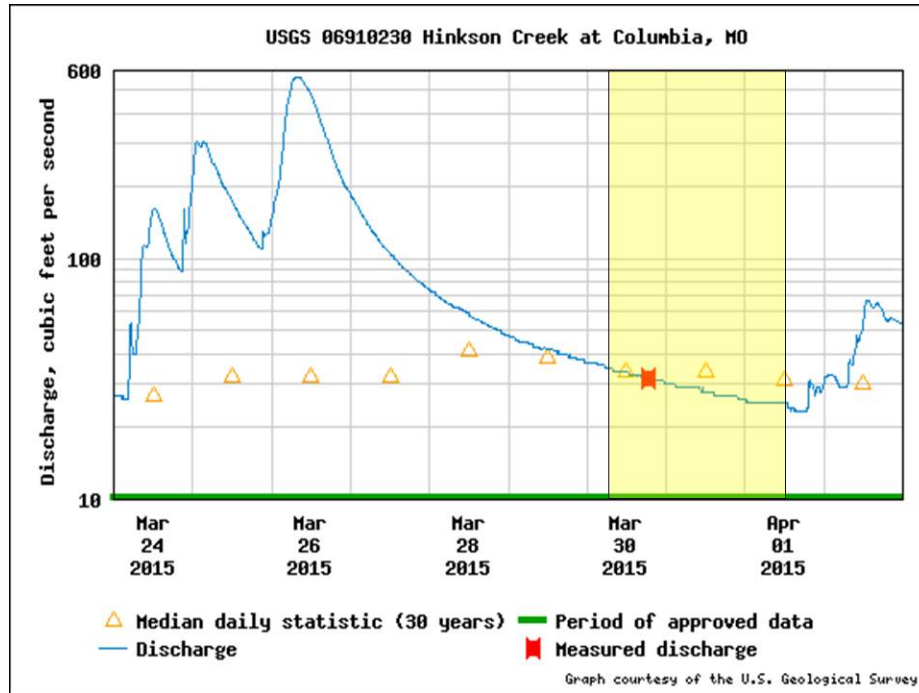


Figure 4. USGS gaging station hydrograph at Providence Road, March 24-April 1, 2015. Highlighted area indicates sampling dates.

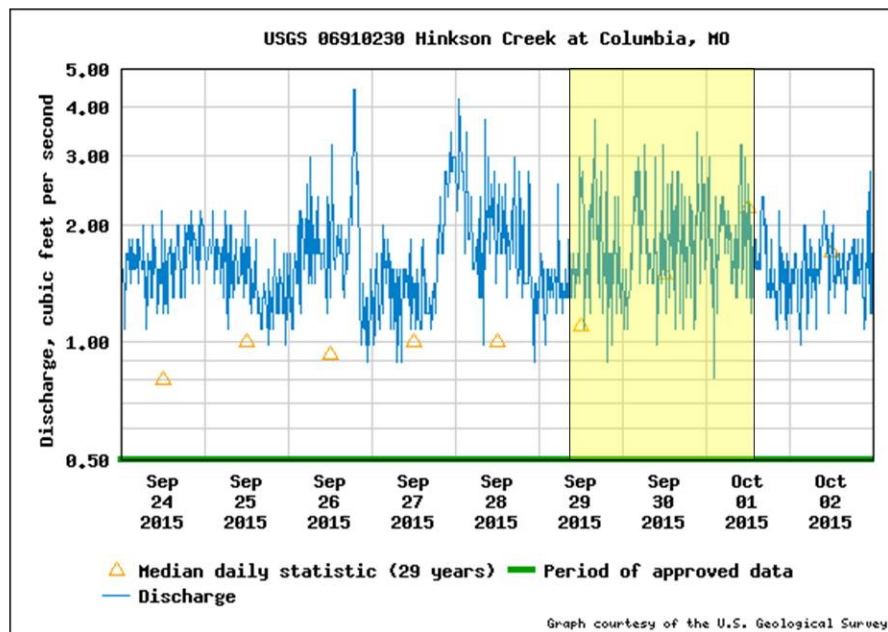


Figure 5. USGS gaging station hydrograph at Providence Road, September 24-October 2, 2015. Highlighted area indicates sampling dates.

A standardized sample collection procedure was followed as described in the *Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (SMSBPP)* (MoDNR 2012). Three standard habitats—flowing water over coarse substrate (riffles and runs), depositional substrate in non-flowing water (pools), and rootmat at the stream edge—were sampled at all locations when available.

HC Stations 1 and 2 are different in general appearance compared to the remaining upstream stations. These downstream stations are characterized by slower flow; steep, muddy banks; and an abundance of large woody debris. Although riffle habitat is present at these stations, they tend to be shorter and have more fine sediment than Stations 3-8. Based on these characters, Stations 1 and 2 not only have features of riffle/pool dominant stream types, but also glide/pool systems. To investigate whether habitat character has an effect on macroinvertebrate scores, a fourth habitat type (large woody debris) was sampled at HC Stations 1 and 2 as specified in the SMSBPP (MoDNR 2012). These stations are assessed using riffle/pool as well as glide/pool criteria thresholds in this report.

Laboratory processing was consistent with the description in the SMSBPP (MoDNR 2012). Each sample was processed under 10x magnification to remove a habitat-specific target number of individuals from debris. Individuals were identified to standard taxonomic levels (MoDNR 2016i) and enumerated.

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (**TR**); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (**EPTT**); 3) Biotic Index (**BI**); and 4) Shannon Diversity Index (**SDI**). These metrics were scored and combined to form the Macroinvertebrate Stream Condition Index (**MSCI**). MSCI scores of 16-20 qualify as fully supporting, 10-14 are partially supporting, and 4-8 are considered non-supporting of the protection of warm water aquatic life beneficial use designation as specified in the Missouri Water Quality Standards (MoDNR 2014b). The macroinvertebrate data, separated by habitat, are included in Appendix A as laboratory bench sheets.

Macroinvertebrate data were examined in the following ways: 1) longitudinal comparisons were made among HC reaches to address differences between rural (Stations 6.5, 7, and 8) and urban (Stations 1-6) segments of the creek; 2) protocols for dominant habitat type (riffle/pool vs. glide pool) were compared at HC Stations 1 and 2; 3) rural and urban HC stations were compared to BFC stations; 4) data from HC stations sampled in 2015 were compared to those obtained from HC in previous years; and 5) recent average macroinvertebrate metric values (2012 to the present) were compared to older MoDNR data collected between 2001 and 2006.

Data were statistically analyzed using t-tests in the software program SigmaStat® to compare differences in biological metric values from the two time periods listed above. When data failed the normality test, the nonparametric Mann-Whitney Rank Sum Test

was performed. Statistical significance was determined at the $\alpha = 0.05$ level. Paired tests were not conducted on MSCI scores for this report. Per the conditions of the Hinkson Creek CAM agreement, the percentage of fully supporting Hinkson Creek MSCI scores will be compared to that of Ozark/Moreau/Loutre EDU biological criteria reference (**BIOREF**) streams using calculations “consistent with Tables 1.2 and B.1 in the Methodology for the Development of the 2012 Section 303(3) List in Missouri....” The 2012 Listing Methodology Document (MoDNR 2010) is available at <https://dnr.mo.gov/env/wpp/waterquality/303d/docs/2012-lmd.pdf>. These calculations will be conducted in consultation with WPP staff during the analysis of the 2017 bioassessment sample data.

4.2 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements were collected at all stations or collected and returned for analysis at the Environmental Services Program’s (ESP) Chemical Analysis Section (CAS). At BFC, measurements were taken at a single site between the two longitudinally adjacent macroinvertebrate survey stations. Temperature (°C) (MoDNR 2016f), pH (standard units) (MoDNR 2016e), specific conductance ($\mu\text{S}/\text{cm}$) (MoDNR 2016g), and dissolved oxygen (mg/L) (MoDNR 2016h) were measured in the field. Turbidity (NTU) (MoDNR 2016d) was measured and recorded in the ESP Water Quality Monitoring Section (**WQMS**) biology laboratory. Water samples were analyzed by ESP’s CAS for chloride, sulfate, hardness, calcium, magnesium, total phosphorus (**TP**), ammonia-N (**NH₃-N**), nitrate+nitrite-N (**NO₃+NO₂-N**), total nitrogen (**TN**), and total suspended solids (**TSS**). All parameters are reported in mg/L. Procedures outlined in *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* (MoDNR 2016b) and *Field Sheet and Chain-of-Custody Record* (MoDNR 2016c) were followed when collecting water quality samples.

Stream velocity was measured at each station where practicable during the study using a SonTek® FlowTracker®. Discharge was calculated per the methods in *Flow Measurement in Open Channels* (MoDNR 2015b).

Physicochemical data were summarized and presented in tabular form for comparison among HC stations and also for comparison between HC and BFC stations.

4.3 Quality Assurance/Quality Control (QA/QC)

4.3.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with *Quality Control Procedures for Checking Water Quality Field Instruments* (MoDNR 2016j).

4.3.2 Biological Samples

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the SMSBPP document (MoDNR 2012).

4.3.3 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with *Quality Control Procedures for Data Processing* (MoDNR 2016k).

4.3.4 Duplicate Sample Collection

Duplicate water chemistry samples are collected for every 10 samples (MoDNR 2013b). Duplicate samples were collected and analyzed for physicochemical parameters at BFC Station 1 during both 2015 sampling seasons. Duplicate macroinvertebrate samples also are collected during each sample season from three randomly selected stations from all current biological study sites. BFC Station 1 was chosen as a macroinvertebrate duplicate sample location in spring 2015.

Duplicate samples are analyzed and reported independently. Duplicate macroinvertebrate samples are analyzed for Quantitative Similarity Index for Taxa (**QSIT**), which compares the two samples in terms of presence or absence of taxa and taking relative abundance (percent composition) of each taxon into account (MoDNR 2012). Duplicate macroinvertebrate samples are expected to have a 70 percent or greater taxa similarity (Rabeni et al. 1999; MoDNR 2012). Duplicate water chemistry sample analyses are assessed by the CAS Chief, who ensures data validation and consistency of analytical results (MoDNR 2015a).

5.0 Results

5.1 Physicochemical Data

Appendix B includes tables that present all HC and BFC water quality parameters, sample numbers, as well as sample times and dates collectively. The tables present physicochemical parameters separately by season. Duplicate water chemistry samples collected during both sample seasons were deemed acceptable during the CAS data review and validation process according to the Fiscal Year 2016 Quality Assurance Project Plan (MoDNR 2015).

Spring 2015

Spring 2015 stream flow and *in situ* water quality data for this study are presented in Table 1. Because HC flows had been >500 cfs during the previous week, sample collection began with Station 8 where the creek is smaller, with the expectation that discharge would continue to decrease with time, and sampling conditions would be more suitable in the deeper downstream stations later in the week. Turbidity was generally higher among upstream stations but tended to decrease during the course of two days of sampling.

Although there was some variability among stations, flow generally tended to increase from upstream to downstream in the spring. Temperature and dissolved oxygen followed patterns consistent with time of day. Among samples collected on March 30, 2015, temperature and dissolved oxygen were lowest at Station 8 (which was sampled at 0915h) and highest at Station 5 (sampled at 1640h). Although temperature among stations sampled on the following day (in the order of Stations 4 to 1) followed a typical

warming trend with time of day, dissolved oxygen exhibited very little change among sites. Conductivity tended to increase from upstream stations to downstream, and pH was nearly the same among all HC sites. As mentioned earlier, turbidity was higher among upstream stations sampled on March 30; on the following day, turbidity readings were slightly lower. Duplicate samples from BFC indicated that flow, dissolved oxygen, pH, and turbidity readings all were lower than HC stations. BFC temperature and conductivity, however, were similar to at least some of the HC sites.

Spring 2015 nutrient and chloride concentrations are presented in Table 2, and additional water quality parameters are included in Table 3. $\text{NH}_3\text{-N}$ concentrations were below detectable limits or below laboratory Practical Quantitation Limits (**PQL**) at all HC stations. $\text{NO}_3\text{+NO}_2\text{-N}$, TN, and TP concentrations, as well as calcium and magnesium were highest at the upstream HC Stations 6.5-8. Among the downstream (more urbanized) HC stations, these nutrients were present in lower concentrations, some of which were below detectable limits or PQLs. Chloride concentrations exhibited a steady increasing trend from upstream to downstream HC stations, with the exception that HC 1 was slightly lower than HC 2 and 3. Chloride concentrations were below water quality standards at all stations (MoDNR 2014). Hardness and sulfate were lowest at HC 7 and 8, and both of these analytes tended to increase in downstream stations. Nearly all HC sulfate samples required dilution during chemical analysis (Table 3). TSS concentrations were variable among HC stations and did not appear to follow a distinct pattern. For duplicate samples collected at BFC, $\text{NH}_3\text{-N}$ and TP concentrations both were below PQLs, and TN was present in slightly lower concentrations than HC sites. BFC chloride concentrations were higher than those collected among rural HC stations, but lower than the downstream urban sites. BFC calcium and magnesium concentrations were similar to HC, and hardness was comparable to the mid-range among HC samples. The lowest HC sulfate concentration was nearly four times higher than the higher BFC sulfate reading. When comparing the extremes in sulfate concentrations (HC 2 versus BFC 1b), the HC concentration was nearly six times that of the BFC sample. Despite the differences in sulfate concentrations among stations, none were higher than the water quality standard (MoDNR 2014).

Table 1
Spring 2015 Flow and *In situ* Water Quality Measurements

Station	Date & Time	Parameter					
		Flow (cfs)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
HC 8	3/30; 0915h	12.5	6.6	11.47	373	8.2	16.6
HC 7	3/30; 1025h	13.2	7.4	12.40	410	8.0	18.5
HC 6.5	3/30; 1155h	17.1	8.5	13.44	466	8.5	16.1
HC 6	3/30; 1350h	18.2	12.2	14.05	492	8.5	13.4
HC 5.5	3/30; 1510h	17.7	13.4	14.83	512	8.8	12.2
HC 5	3/30; 1640h	22.4	14.1	15.15	534	8.8	10.6
HC 4	3/31; 0905h	27.7	9.8	11.15	588	7.9	8.87
HC 3.5	3/31; 1015h	27.8	10.7	11.02	586	8.1	8.45
HC 3	3/31; 1135h	31.8	11.9	10.72	616	8.1	7.58
HC 2	3/31; 1325h	28.5	13.7	11.42	606	8.1	8.94
HC 1	3/31; 1500h	33.4	14.8	11.80	603	8.1	12.5
BFC 1a	4/1; 0910h	5.7	11.0	9.63	450	7.7	2.64
BFC 1b (dup)	4/1; 0915h	6.1	11.0	9.77	452	7.7	2.08

Table 2
Spring 2015 Nutrient and Chloride Concentrations

Station	Date & Time	Parameter (mg/L)				
		NH ₃ -N	NO ₃ +NO ₂ -N	Total Nitrogen	Total Phosphorus	Chloride
HC 8	3/30; 0915h	<0.03*	0.21	0.72	0.072	12.1
HC 7	3/30; 1025h	<0.03*	0.17	0.67	0.055	12.8
HC 6.5	3/30; 1155h	<0.03*	0.099	0.58	0.051	18.0
HC 6	3/30; 1350h	0.034**	0.061	0.55	0.048	24.8
HC 5.5	3/30; 1510h	<0.03*	0.030	0.49	0.046	31.1
HC 5	3/30; 1640h	0.037**	0.0097**	0.54	0.042	35.9
HC 4	3/31; 0905h	<0.03*	<0.008*	0.42	0.046	43.2
HC 3.5	3/31; 1015h	0.032**	<0.008*	0.39	0.031**	45.7
HC 3	3/31; 1135h	<0.03*	0.0087**	0.41	0.032**	56.6
HC 2	3/31; 1325h	0.039**	<0.008*	0.41	0.035**	56.9
HC 1	3/31; 1500h	0.042**	0.016	0.43	0.043	54.2
BFC 1a	4/1; 0910h	0.035**	0.026	0.27	0.035**	23.4
BFC 1b(dup)	4/1; 0915h	0.031**	0.028	0.27	0.029**	23.0

*Below detectable limits

**Estimated value, detected below Practical Quantitation Limits

Table 3
Hinkson and Bonne Femme Creek Spring 2015 Water Chemistry Parameters

Station	Date & Time	Parameter (mg/L)				
		Calcium	Magnesium	Hardness	Sulfate	TSS
HC 8	3/30; 0915h	46.2	7.58	147	64.4	8.00
HC 7	3/30; 1025h	53.1	8.32	167	77.8	9.00
HC 6.5	3/30; 1155h	61.3	9.37	192	89.7*	9.00
HC 6	3/30; 1350h	66.2	10.2	207	91.2*	13.0
HC 5.5	3/30; 1510h	67.3	10.0	209	92.3*	10.0
HC 5	3/30; 1640h	69.9	10.4	217	94.9*	9.00
HC 4	3/31; 0905h	73.9	10.6	228	94.8*	5.00
HC 3.5	3/31; 1015h	75.2	10.2	231	94.4*	<5.00**
HC 3	3/31; 1135h	76.1	10.6	234	90.3*	<5.00**
HC 2	3/31; 1325h	77.9	10.8	239	96.3	6.00
HC 1	3/31; 1500h	79.0	10.9	242	88.7	8.00
BFC 1a	4/1; 0910h	65.8	6.83	192	16.7	<5.00**
BFC 1b (dup)	4/1; 0915h	65.7	6.84	192	16.1	<5.00**

*Sample was diluted during analysis

**Below detectable limits

Fall 2015

Fall 2015 stream flow and *in situ* water quality data are presented in Table 4. Flow conditions were extremely low at both HC and BFC. HC 7 and 8 had no surface flow in riffles, so water chemistry samples were not collected at either station. Temperature, and to a lesser degree, dissolved oxygen varied with time of day among HC stations. HC 1 and HC 5 both were sampled first on consecutive days, but they did not have the lowest dissolved oxygen concentrations among samples collected on their respective days. HC 2, which was sampled at 1106h, had the lowest dissolved oxygen concentration of any HC or BFC sites, and it was the only site to have a dissolved oxygen level lower than the minimum water quality standard of 5.0 mg/L. Although conductivity tended to be higher among upstream stations, there was sufficient variability among sites to negate any definite trend from upstream to downstream. pH readings of HC 3-6.5 were nearly identical, and HC 1 and 2 were slightly lower. Turbidity was similar among stations, except that HC 1, 2, and 5.5 were slightly more turbid than the remaining stations. BFC had lower temperature and conductivity than HC sites, but the other *in situ* measurements were similar.

Nutrient and chloride concentrations for fall 2015 are presented in Table 5, and the remaining water quality parameters are included in Table 6. NH₃-N, NO₃+NO₂-N, and TP all were present in detectable concentrations among at least some HC sites. There appeared to be no longitudinal pattern in where these nutrients were detected and in what concentrations. Nutrients with non-detectable levels or concentrations below PQLs were interspersed throughout the HC survey reach. TN was the only nutrient parameter that was present in detectable concentrations at all sites. TN concentrations were similar among all HC and BFC sites, with the exception of HC 5.5, where it was slightly higher. Chloride was highly variable among HC sites with no longitudinal pattern. The highest

chloride concentrations occurred at HC 3 (98.2 mg/L), whereas the lowest concentration was downstream at HC 1. The two lowest chloride HC concentrations occurred at opposite ends of the fall 2015 survey reach (HC 1 and 6.5). Compared to BFC, HC chloride concentrations were roughly between four and 10 times higher. BFC nutrient concentrations ($\text{NH}_3\text{-N}$, $\text{NO}_3\text{+NO}_2\text{-N}$, TN, and TP) were present in similar levels compared to HC.

The remaining water quality parameters presented in Table 6 also exhibited few patterns. Although all calcium and magnesium samples required dilution during analysis, there was considerable variability among HC stations. BFC calcium and magnesium levels were only slightly lower than HC. Sulfate concentrations were similarly variable among HC sites, and the highest HC sulfate concentrations were at least 20 times higher than BFC. Likewise, hardness concentrations were variable among HC stations, and BFC had hardness levels that were similar to HC. Most TSS concentrations were below detectable limits, and those concentrations that were detectable were only slightly higher than the laboratory threshold.

Seasonal differences were apparent among several water quality parameters. Notably, flow was much lower in the fall sample season, and although dissolved oxygen was lower among all sample sites in the fall, only HC 2 had a concentration below the minimum WQS. Conductivity was higher among all HC stations in the fall, but the downstream stations (HC 1-3) were more similar between seasons. There was almost no difference in BFC conductivity between seasons. Turbidity was higher among all HC stations in spring, but BFC had slightly lower spring turbidity readings. Nutrient parameters were present in low concentrations during both seasons, but $\text{NH}_3\text{-N}$, TN, and TP were slightly higher in spring samples. There was sufficient $\text{NO}_3\text{+NO}_2\text{-N}$ variability among stations that no definitive seasonal trends exist. Overall, chloride concentrations tended to be higher in fall samples but, as mentioned earlier, HC also had considerable variability among stations in the fall. Calcium, magnesium, hardness, and TSS all were higher among fall HC samples; sulfate, however, was variable. Sulfate at HC 1-3 was higher in spring, but in fall sulfate concentrations were higher among HC 4-6.5.

Table 4
Fall 2015 Flow and *In situ* Water Quality Measurements

Station	Date & Time	Parameter					
		Flow (cfs)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
HC 8	Not sampled due to low flow conditions.						
HC 7							
HC 6.5	9/30; 1425h	0.2	22.1	8.12	847	8.0	3.4
HC 6	9/30; 1250h	0.6	19.4	9.23	860	8.2	2.1
HC 5.5	9/30; 1048h	1.0	20.5	7.66	677	8.0	5.1
HC 5	9/30; 0910h	1.1	17.8	7.72	825	8.2	2.9
HC 4	9/29; 1555h	0.7	23.6	9.95	750	8.1	2.9
HC 3.5	9/29; 1445h	0.9	22.7	8.36	741	8.0	2.6
HC 3	9/29; 1330h	0.8	23.7	8.35	756	7.9	3.1
HC 2	9/29; 1106h	1.0	19.6	4.93	755	7.6	7.3
HC 1	9/29; 0925h	1.4	19.7	6.76	713	7.7	6.4
BFC 1a	10/1; 0930h	0.1	14.9	6.90	478	7.7	5.2
BFC 1b (dup)	10/1; 0935h	0.1	14.9	6.80	477	7.9	4.1

Table 5
Fall 2015 Nutrient and Chloride Concentrations

Station	Date & Time	Parameter (mg/L)				
		NH ₃ -N	NO ₃ +NO ₂ -N	Total Nitrogen	Total Phosphorus	Chloride
HC 8	Not sampled due to low flow conditions.					
HC 7						
HC 6.5	9/30; 1425h	0.042**	<0.008*	0.36	0.036**	39.6
HC 6	9/30; 1250h	0.068	<0.008*	0.34	0.027	57.3
HC 5.5	9/30; 1048h	0.062	0.11	0.60	0.051	50.6
HC 5	9/30; 0910h	0.040**	0.0095**	0.30	0.045	63.4
HC 4	9/29; 1555h	<0.03*	<0.008*	0.27	0.037**	56.7
HC 3.5	9/29; 1445h	0.037**	<0.008*	0.27	0.022**	49.4
HC 3	9/29; 1330h	0.050 [†]	0.011	0.27	0.025	98.2
HC 2	9/29; 1106h	0.085	0.038	0.36	0.042**	53.1
HC 1	9/29; 0925h	0.049**	0.029	0.36	0.042**	38.7
BFC 1a	10/1; 0930h	0.036**	0.083	0.41	0.056	11.3
BFC 1b (dup)	10/1; 0935h	<0.03*	0.081	0.35	0.049**	10.2

*Below detectable limits

**Estimated value, detected below Practical Quantitation Limits

[†]Estimated value, matrix interference

Table 6
Hinkson and Bonne Femme Creek Fall 2015 Water Chemistry Parameters

Station	Date & Time	Parameter (mg/L)				
		Calcium	Magnesium	Hardness	Sulfate	TSS
HC 8	Not sampled due to low flow conditions.					
HC 7						
HC 6.5	9/30; 1425h	119*	16.4*	365	189*	<5.00**
HC 6	9/30; 1250h	102*	17.5*	327	179*	<5.00**
HC 5.5	9/30; 1048h	72.6*	15.2*	244	93.9	6.00
HC 5	9/30; 0910h	95.5*	15.4*	302	139*	<5.00**
HC 4	9/29; 1555h	92.8*	13.9*	289	112*	<5.00**
HC 3.5	9/29; 1445h	101*	11.1*	298	77.1	<5.00**
HC 3	9/29; 1330h	98.2*	12.5*	297	74.7	<5.00**
HC 2	9/29; 1106h	104*	13.1*	314	68.4	6.00
HC 1	9/29; 0925h	99.0*	13.1*	301	56.1	6.00
BFC 1a	10/1; 0930h	87.8*	9.28*	257	8.46	<5.00**
BFC 1b (dup)	10/1; 0935h	84.2*	8.82*	247	9.62	5.00

*Sample was diluted during analysis

**Below detectable limits

5.2 Biological Assessment

5.2.1 Biological Assessment QSIT

During the spring sampling season, duplicate samples were collected at BFC Station 1. These samples were analyzed for QSIT to compare the two samples to determine whether they met the 70 percent threshold for duplicate samples (Rabeni et al. 1999, MDNR 2012). The QSIT for these two samples was 79.0 percent.

5.2.2 Hinkson Creek Longitudinal Comparison

Spring 2015

HC and BFC spring 2015 macroinvertebrate community metrics were calculated using biological criteria derived from reference streams in the Ozark/Moreau/Loutre EDU (Table 7). In spring 2015, four of the 11 HC stations had fully supporting MSCI scores of 16. All fully supporting MSCI scores occurred in the upstream portion of the watershed (HC 6-8). Only one of the HC stations downstream of HC 6 attained MSCI scores of 14 (HC 4); the remainder had scores of 12 (Table 7).

Stations with partially supporting MSCI scores had suboptimal TR, EPTT, and SDI values. Of the seven HC sites with partially supporting scores, six had the lowest possible score for the EPTT metric, and no stations (including those with fully supporting MSCI scores) had optimal EPTT values. HC 6, which was the only urban station to attain a fully supporting MSCI score, was also the only site to attain an optimal BI value. It was this BI value that led to the fully supporting MSCI score for HC 6; unlike the remaining stations with fully supporting scores, HC 6 had a suboptimal TR value. SDI was the only biological metric to have optimal values among all HC stations.

Table 7
Metric Values and Scores for Hinkson Creek and Bonne Femme Creek Stations, Spring
2015, Using Ozark/Moreau/Loutre Biological Criteria

Site	TR	EPTT	BI	SDI	MSCI	Support
HC 8 Value	74	11	7.0	3.14		Full
HC 8 Score	5	3	3	5	16	
HC 7 Value	76	12	6.5	3.18		Full
HC 7 Score	5	3	3	5	16	
HC 6.5 Value	80	12	6.5	3.27		Full
HC 6.5 Score	5	3	3	5	16	
HC 6 Value	70	10	6.3	2.88		Full
HC 6 Score	3	3	5	5	16	
HC 5.5 Value	66	7	6.6	2.93		Partial
HC 5.5 Score	3	1	3	5	12	
HC 5 Value	65	8	6.5	3.07		Partial
HC 5 Score	3	1	3	5	12	
HC 4 Value	69	10	6.4	2.96		Partial
HC 4 Score	3	3	3	5	14	
HC 3.5 Value	69	8	6.5	3.19		Partial
HC 3.5 Score	3	1	3	5	12	
HC 3 Value	62	7	6.6	3.09		Partial
HC 3 Score	3	1	3	5	12	
HC 2 Value	63	6	6.6	3.22		Partial
HC 2 Score	3	1	3	5	12	
HC 1 Value	63	6	6.9	3.22		Partial
HC 1 Score	3	1	3	5	12	
BFC 1a Value	70	12	6.4	2.76		Partial
BFC 1a Score	3	3	3	3	12	
BFC 1b Value	69	10	6.4	2.98		Partial
BFC 1b Score	3	3	3	5	14	
BFC 2 Value	69	8	6.5	2.56		Partial
BFC 2 Score	3	1	3	3	10	
BIOREF Score=5	>71	>17	<6.4	>2.80	20-16	Full
BIOREF Score=3	71-35	17-9	6.4-8.2	2.80-1.40	14-10	Partial
BIOREF Score=1	<35	<9	>8.2	<1.40	8-4	Non

Mayflies were present in low abundance among all HC and BFC stations compared to the mean of BIOREF samples. Whereas the highest percentage of mayflies in HC samples occurred at HC 2 (4.2 percent), the average among BIOREF spring samples is 28.9 percent. Mayflies made up between 0.9 percent (HC 5.5) and 4.2 percent (HC 2) of samples. The relative abundance of mayflies in BFC samples was similar to the lower percentages of HC samples. No HC or BFC station had more than five mayfly taxa in spring samples (7 of 14 samples had five mayfly taxa), and the lowest number of mayfly taxa occurred at BFC 1b where there were two taxa. *Caenis latipennis* and *Stenonema femoratum* were the only two mayfly taxa to occur in each sample.

Caddisflies made up a similar percentage of several HC stations compared to BIOREF samples. The average relative abundance of caddisflies among spring BIOREF samples is 1.9 percent, which was similar to HC 6 and HC 7. Caddisflies made up the lowest percentage of samples among the three downstream stations and HC 8. Whereas HC 1-HC 3 had a single caddisfly taxon (*Cheumatopsyche*), however, HC 8 had five. The three samples collected at BFC had among the lowest abundance of caddisflies in spring 2015. The number of caddisfly taxa among HC stations increased from HC 3.5 (two taxa) to HC 4 (six taxa). Stations upstream of HC 3.5 had between four and six caddisfly taxa.

Stoneflies were absent or nearly absent from all HC urban stations. With the exception of a single immature Perlidae specimen at HC 3.5, no stoneflies were present in HC samples collected downstream of Interstate 70. Although stoneflies were found in the rural HC reach, none of the three upstream stations had more than two stonefly taxa. Station 6.5 was the only HC station to have two stonefly taxa; HC 7 and 8 each had only one (*Perlesta*). Samples had between three (BFC 2) and five (BFC 1b) stonefly taxa at BFC. The highest stonefly relative abundance occurred at BFC 1b (2.2 percent); by comparison, the average among spring BIOREF samples is 9.1 percent.

Chironomidae, Tubificidae, and Elmidae were the dominant taxa groups among all HC and BFC spring 2015 samples. Chironomidae made up between 70.8 and 85.2 percent of samples (Table 8), which was considerably higher than the mean Ozark/Moreau/Loutre EDU BIOREF chironomid relative abundance of 26.9 percent. A total of 60 chironomid taxa were collected in HC and BFC, but the number ranged from 32-37 among individual stations. Three taxa groups made up the majority of chironomids. *Cricotopus/Orthocladius* grp., *Polypedilum* spp., and *Tanytarsus* tended to be the most abundant chironomids, making up between 38 percent (HC 8) and 59 percent (HC 6) of overall samples.

Aquatic worms in the family Tubificidae made up between 1.3 percent (HC 4) to 8.8 percent (HC 1) of samples. Several stations had tubificid abundance that was greater than the BIOREF percentage (3.2 percent), whereas for others it was similar. The highest percentage of tubificids and other aquatic worm groups (Enchytraeidae, Lumbriculidae, and Lumbricina) occurred at HC 1. Stations HC 3, HC 5.5, HC 6.5, and BFC 2 also had aquatic worm relative abundance that was higher than the remaining stations.

Riffle beetles in the family Elmidae also were among the dominant taxa at all HC and BFC samples. Two genera (*Stenelmis* and *Dubiraphia*) were present among all sites. A third elmid, *Macronychus glabratus*, was present only at HC 1. *Stenelmis* tended to be the dominant riffle beetle taxon among all sites, particularly among BFC samples, in which only a single *Dubiraphia* individual was present in samples.

Table 8
Spring 2015 Hinkson and Bonne Femme Creek Riffle/Pool Macroinvertebrate Composition

↓ Variable	Station→	1	2	3	3.5	4	5	5.5	6	6.5	7	8	BFC1a	BFC1b	BFC2
Taxa Richness		63	63	62	69	69	65	66	70	80	76	74	70	69	69
Number EPT Taxa		6	6	7	8	10	8	7	10	12	12	11	12	10	8
% Ephemeroptera		2.4	4.2	3.7	1.6	2.3	2.6	0.9	1.6	1.9	1.7	1.4	1.0	1.2	1.1
% Plecoptera		0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.8	2.2	1.7	0.2
% Trichoptera		0.2	0.6	0.2	1.0	1.2	1.4	1.1	2.2	1.3	1.7	0.9	0.3	0.2	0.2
MSCI Score		12	12	12	12	14	12	12	16	16	16	16	12	14	10
% Dominant Families															
Chironomidae		81.9	79.1	78.0	77.0	85.2	83.0	81.5	83.1	70.8	72.2	78.8	78.4	80.3	76.6
Tubificidae		8.8	3.9	7.0	6.5	1.3	2.5	7.2	2.6	5.6	4.6	4.9	2.0	3.5	6.1
Elmidae		1.7	4.0	2.7	6.7	3.5	3.0	3.9	4.1	10.6	8.2	4.3	4.9	5.3	12.8
Heptageniidae		1.2	0.7	0.4	0.4	0.6	0.5	0.3	1.0	0.7	0.3	0.5	0.3	0.6	0.8
Ceratopogonidae		1.2	0.7	0.7	0.7	0.4	0.5	0.5	0.3	0.2	0.6	0.5	0.3	0.4	0.4
Caenidae		1.0	3.2	3.0	1.2	1.2	1.8	0.6	0.6	0.8	1.0	0.7	0.6	0.6	0.4
Simuliidae		<0.1	3.1	2.4	1.6	1.3	1.4	1.7	3.2	3.0	6.8	3.7	0.3	0.2	0.2
Arachnida		0.6	0.8	0.9	0.6	1.6	1.5	0.7	0.5	1.3	0.6	0.8	0.2	0.7	0.8
Coenagrionidae		0.2	0.5	1.5	2.3	0.4	1.9	0.6	0.3	0.8	0.5	0.5	0.4	0.2	0.4
Hydropsychidae		0.2	0.6	0.2	0.9	0.8	1.1	0.8	1.5	0.8	0.6	0.7	0.1	0.2	0.0
Pisidiidae		0.0	0.5	0.0	0.2	<0.1	0.5	<0.1	<0.1	0.4	0.2	1.0	0.0	0.0	<0.1
Asellidae		0.0	<0.1	0.0	0.2	0.0	<0.1	0.0	<0.1	<0.1	0.0	0.0	4.9	1.7	0.5
Crangonyctidae		0.0	<0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	<0.1	3.9	3.9	0.5
Perlidae		0.0	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.8	0.9	0.6	<0.1

Numbers in bold represent the top five dominant taxa.

Fall 2015

HC and BFC fall 2015 macroinvertebrate community metrics were calculated using biological criteria derived from reference streams in the Ozark/Moreau/Loutre EDU (Table 9). Due to low flow conditions in the upper portion of the watershed, samples were not collected from HC 7 and HC 8. In fall 2015, seven of the nine HC stations and both BFC stations sampled attained fully supporting MSCI scores. Although most fully supporting scores were 16, HC 6 had an MSCI score of 18 and HC 1 achieved a top score of 20. These were also the only two stations to have optimal scores for the TR and EPTT metrics. Stations 4 and 5 each had partially supporting MSCI scores of 14 due to suboptimal scores for TR, EPTT, and BI.

Chironomidae, Hydropsychidae, and Baetidae were among the dominant taxa groups at all HC stations except HC 4 and HC 6. Baetidae ranked seventh at HC 4, and Hydropsychidae was sixth in abundance at HC 6 (Table 10).

Table 9
Metric Values and Scores for Hinkson Creek and Bonne Femme Creek Stations, Fall 2015, Using Ozark/Moreau/Loutre Biological Criteria

Site	TR	EPTT	BI	SDI	MSCI	Support
HC 8	Not sampled due to low flow conditions.					
HC 7	Not sampled due to low flow conditions.					
HC 6.5 Value	70	14	6.5	3.48		
HC 6.5 Score	3	3	5	5	16	Full
HC 6 Value	75	17	6.9	3.41		
HC 6 Score	5	5	3	5	18	Full
HC 5.5 Value	69	11	6.7	3.37		
HC 5.5 Score	3	3	5	5	16	Full
HC 5 Value	69	12	6.8	3.36		
HC 5 Score	3	3	3	5	14	Partial
HC 4 Value	68	13	7.0	3.26		
HC 4 Score	3	3	3	5	14	Partial
HC 3.5 Value	72	12	6.7	3.35		
HC 3.5 Score	3	3	5	5	16	Full
HC 3 Value	73	8	6.6	3.37		
HC 3 Score	3	3	5	5	16	Full
HC 2 Value	73	15	6.5	3.46		
HC 2 Score	3	3	5	5	16	Full
HC 1 Value	77	16	6.6	3.27		
HC 1 Score	5	5	5	5	20	Full
BFC 1 Value	74	13	6.7	3.20		
BFC 1 Score	5	3	5	5	18	Full
BFC 2 Value	72	10	6.5	3.45		
BFC 2 Score	3	3	5	5	16	Full
BIOREF Score=5	>73	>15	<6.8	>3.18	20-16	Full
BIOREF Score=3	73-37	15-7	6.8-8.4	3.18-1.59	14-10	Partial
BIOREF Score=1	<37	<7	>8.4	<1.59	8-4	Non

Table 10
Fall 2015 Hinkson and Bonne Femme Creek Riffle/Pool Macroinvertebrate Composition

↓Variable	Station→	1	2	3	3.5	4	5	5.5	6	6.5	7	8	BFC1	BFC2
Taxa Richness		77	73	73	72	68	69	69	75	70	No samples collected due to low flow conditions.		74	72
Number EPT Taxa		16	15	8	12	13	12	11	17	14			13	10
% Ephemeroptera		17.6	21.2	21.2	18.7	26.8	22.5	19.5	18.3	20.6			22.4	23.3
% Plecoptera		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0
% Trichoptera		18.3	12.4	18.9	20.0	9.9	19.5	12.8	6.7	19.8			25.7	17.5
MSCI Score		20	16	16	16	14	14	16	18	16			18	16
% Dominant Families														
Chironomidae		46.3	45.4	32.7	29.1	38.9	34.4	34.6	43.0	30.1			25.3	36.8
Hydropsychidae		17.1	11.3	18.2	19.1	9.6	18.7	11.9	5.1	13.9			22.2	11.7
Baetidae		10.7	11.1	11.3	7.3	3.8	7.2	8.9	6.2	7.8			6.8	8.8
Simuliidae		5.3	<0.1	1.5	1.7	0.1	0.9	1.2	2.2	3.0			0.7	1.0
Coenagrionidae		3.7	1.2	4.7	7.2	6.7	7.9	7.0	4.0	3.9			1.4	2.2
Pisidiidae		<0.1	4.6	1.2	<0.1	0.5	0.0	1.0	0.5	1.0			0.0	0.0
Heptageniidae		3.1	4.3	4.0	5.7	12.7	6.9	4.4	4.5	2.9			7.8	8.9
Elmidae		2.0	4.1	5.1	6.7	6.4	3.5	10.2	2.8	6.7			3.7	4.7
Tubificidae		1.6	1.7	4.9	3.7	2.9	1.2	1.8	1.4	1.5			5.9	4.7
Caenidae		3.0	1.8	3.6	2.8	8.9	6.5	6.1	7.5	9.6			7.6	5.5
Corbiculidae		0.2	4.0	2.7	5.7	2.9	3.0	5.3	11.2	1.0			0.0	0.3
Physidae		0.2	0.0	<0.1	0.2	<0.1	0.0	0.2	5.4	1.5			<0.1	0.2
Hyaellidae		0.0	0.7	<0.1	0.3	0.3	0.7	0.4	0.3	3.0			9.9	2.7

Numbers in bold represent the top five dominant taxa.

The caddisfly family Hydropsychidae, which was made up almost exclusively of *Cheumatopsyche*, was among the five dominant taxa at all stations except HC 6. A second hydropsychid caddisfly, *Hydropsyche*, was present in low numbers among six of the nine HC stations sampled with no discernible distribution pattern.

The mayfly family Baetidae was among the top dominant taxa at all HC stations except HC 4 and BFC 2. Although there were four baetid genera present among samples, *Acerpenna* and *Baetis* accounted for all or nearly all specimens in this family. Neither genus was consistently dominant among all samples.

Other dominant taxa that occurred in higher abundance than those mentioned above included Heptageniidae at HC 4, Corbiculidae at HC 6, and Hyaellidae at BFC 1. HC 4 had an unusually high number of *Stenonema femoratum* and *Stenacron* compared to the remaining stations, which resulted in Heptageniidae ranking among the dominant taxa. HC 6 had more than twice as many Asian clams (Corbiculidae) present in fall 2015 compared to the next nearest sample, and BFC 1 had at least three times more *Hyaella azteca* (Hyaellidae) compared to any other station.

Mayfly abundance was roughly similar among HC and BFC stations; no single site had an exceptionally high or low percentage of mayflies in samples (abundance ranged from 17.6 percent at HC 1 to 26.8 percent at HC 4). Compared to relative mayfly abundance among BIOREF samples (27.3 percent), at least some HC samples were comparable. Although the number of mayfly taxa exhibited some variability among stations, there was no trend. The highest number of mayfly taxa (11) was observed at HC 2, and the lowest (6) occurred at HC 3 and HC 5.5. Although no single mayfly taxon was consistently dominant across all stations, several were present at all stations. Mayflies present in all samples included *Acerpenna*, *Caenis latipennis*, *Stenacron*, and *S. femoratum*.

Stoneflies were absent from all HC and BFC stations in fall 2015. Although present in some BIOREF samples, stoneflies tend to be rare even in reference conditions during the fall season. On average stoneflies have a 0.10 percent relative abundance among fall BIOREF samples.

As referenced earlier, caddisflies were abundant among HC and BFC stations, and one caddisfly family (Hydropsychidae) ranked as one of the top five dominant taxa at all HC stations except HC 6. Of the nine HC stations sampled in fall 2015, caddisflies made up roughly 20 percent at five of them, which is similar to the average BIOREF caddisfly abundance (19.8 percent). The number of caddisfly taxa varied between two taxa at HC 3 to seven taxa at HC 1 and HC 6. The genus *Cheumatopsyche* accounted for the majority (67.4 to 96.7 percent) of caddisflies in HC and BFC.

Compared to spring samples, chironomids were not overwhelmingly dominant in HC and BFC fall 2015 samples. Chironomids made up between 25.3 (BFC 1) and 46.3 (HC 1) percent of samples, which was comparable to the average among BIOREF samples (32.7 percent). Although HC 1 had the highest percentage of chironomids, HC 2, and HC 6 were similar. A total of 49 chironomid taxa were present in HC and BFC samples in aggregate; among individual sites, the number of taxa ranged from 23 (HC 5.5) to 32 (HC 1 and BFC 2). Two genera, *Polypedilum* spp. and *Tanytarsus*, were highest in chironomid abundance among both HC and BFC sites. These two groups accounted for between 7.8 percent (BFC 1) to 24.5 percent (HC 1) of HC samples overall, but at HC 6 *Polypedilum* spp. and *Tanytarsus* made up 93.0 percent of chironomids.

5.2.3 Hinkson Creek Station 1 and Station 2 Riffle/Pool versus Glide/Pool Data Comparison

Spring 2015

Ozark/Moreau/Loutre EDU spring riffle/pool and glide/pool biological criteria are presented in Table 11. HC 1 and HC 2 had the same MSCI scores within habitat regimes (Table 12). Both stations attained slightly higher MSCI scores with glide/pool sample data, but each remained in the partially supporting range. A lower glide/pool EPTT scoring threshold resulted in the higher MSCI scores for both stations, despite having EPTT values that were similar to riffle/pool sample results.

Table 11
Spring Biological Criteria Calculated from Reference Streams in the
Ozark/Moreau/Loutre EDU

	Riffle/Pool Criteria				Glide/Pool Criteria		
	Score = 5	Score = 3	Score = 1		Score = 5	Score = 3	Score = 1
TR	>71	71-35	<35		>62	62-31	<31
EPTT	>17	17-9	<9		>7	7-3	<3
BI	<6.4	8.2-6.4	>8.2		<6.9	6.9-8.4	>8.4
SDI	>2.80	2.80-1.40	<1.40		>2.72	2.72-1.36	<1.36

Table 12
Hinkson Creek Stations 1 and 2 Riffle/Pool and Glide/Pool Biological Metric Values,
Individual Metric Scores (in Parentheses), and MSCI Scores, Spring 2015

	Riffle/Pool Criteria			Glide/Pool Criteria	
	HC1	HC2		HC1	HC2
TR	63 (3)	63 (3)		59 (3)	61 (3)
EPTT	6 (1)	6 (1)		6 (3)	5 (3)
BI	6.9 (3)	6.6 (3)		6.9 (3)	7.3 (3)
SDI	3.22 (5)	3.22 (5)		3.12 (5)	3.09 (5)
MSCI	12	12		14	14
Support	Partial	Partial		Partial	Partial

Spring 2015 macroinvertebrate community metrics comparing the two habitat regimes are presented in Table 13. There were few major differences at the family level between the two stations or between habitat types. Chironomidae was the overwhelming dominant taxa group at both stations for both habitat types, and Tubificidae was second in abundance. There was a higher proportion of mayflies in the riffle/pool sample at HC 2, but the proportion was nearly identical for HC 1. Caddisflies were rare and stoneflies were absent at both stations, regardless of habitat type.

Table 13
Spring 2015 Hinkson Creek Riffle/Pool versus Glide/Pool Macroinvertebrate Composition

		Riffle/Pool		Glide/Pool	
↓Variable	Station→	1	2	1	2
Taxa Richness		63	63	59	61
Number EPT Taxa		6	6	6	5
% Ephemeroptera		2.4	4.2	2.5	2.3
% Plecoptera		0.0	0.0	0.0	0.0
% Trichoptera		0.2	0.6	0.5	0.1
MSCI Score		12	12	14	14
% Dominant Families					
Chironomidae		81.9	79.1	85.9	84.4
Tubificidae		8.8	3.9	5.0	3.4
Elmidae		1.7	2.7	0.9	1.0
Ceratopogonidae		1.2	0.7	1.4	0.8
Heptageniidae		1.2	0.7	1.1	0.1
Caenidae		1.0	3.2	1.1	2.0
Simuliidae		<0.1	3.1	0.8	3.4
Arachnida		0.6	0.8	1.2	1.0

Fall 2015

Ozark/Moreau/Loutre EDU fall riffle/pool and glide/pool biological criteria are presented in Table 14. Unlike spring samples, there were scoring and support category differences for HC 1 and HC 2 between the two habitat regimes (Table 15). Whereas HC 1 attained fully supporting status with the highest possible MSCI score using riffle/pool criteria, glide/pool criteria yielded a partially supporting MSCI score. The HC 1 glide/pool sample had suboptimal EPTT, BI, and SDI values. The HC 1 glide/pool SDI tied the threshold value of 3.09; a marginally higher value for this metric would have resulted in a fully supporting MSCI score at HC1. The HC 2 glide/pool TR was one taxon higher than the threshold value and attained an optimal metric score, whereas the riffle/pool TR equaled the threshold value and attained a suboptimal score. Similarly, the glide/pool HC 2 BI value tied the threshold value to attain a suboptimal score, but the riffle/pool BI value was in the optimal range.

Table 14
Fall Biological Criteria Calculated from Reference Streams in the Ozark/Moreau/Loutre EDU

	Riffle/Pool Criteria				Glide/Pool Criteria		
	Score = 5	Score = 3	Score = 1		Score = 5	Score = 3	Score = 1
TR	>73	73-37	<37		>66	66-33	<33
EPTT	>15	15-7	<7		>13	13-7	<7
BI	<6.8	6.8-8.4	>8.4		<6.9	6.9-8.4	>8.4
SDI	>3.18	3.18-1.59	<1.59		>3.09	3.09-1.55	<1.55

Table 15
Hinkson Creek Stations 1 and 2 Riffle/Pool and Glide/Pool Biological Metric Values,
Individual Metric Scores (in Parentheses), and MSCI Scores, Fall 2015

	Riffle/Pool Criteria			Glide/Pool Criteria	
	HC1	HC2		HC1	HC2
TR	77 (5)	73 (3)		72 (5)	67 (5)
EPTT	16 (5)	15 (3)		12 (3)	13 (3)
BI	6.6 (5)	6.5 (5)		7.2 (3)	6.9 (6)
SDI	3.27 (5)	3.46 (5)		3.09 (3)	3.32 (5)
MSCI	20	16		14	16
Support	Full	Full		Partial	Full

Fall 2015 macroinvertebrate community metrics comparing the two habitat regimes are presented in Table 16. Unlike spring, fall samples exhibited several differences in taxonomic makeup between the two habitat types. Chironomids made up a much higher percentage of glide/pool samples, and mayflies and caddisflies were present in much lower percentages compared to riffle/pool samples. The caddisfly family Hydropsychidae was second in abundance among riffle/pool samples from both HC 1 and HC 2, but it was present in very low numbers in glide/pool samples. Similarly, whereas the mayfly family Baetidae was third in abundance in riffle/pool samples, it was nearly absent in glide/pool samples. Two mayfly groups (Heptageniidae and Caenidae) were present among the top five taxa in some glide/pool samples, but their abundance was not consistent among the two stations considered.

5.2.4 Comparison of Hinkson and Bonne Femme Creeks Spring 2015

All three samples collected at the two BFC stations yielded partially supporting MSCI scores (Table 7), but similarly-sized rural HC stations (HC 6.5, 7, and 8) all had fully supporting scores. Each of the three rural HC stations had fully supporting TR and SDI values, which worked to overcome the partially supporting EPTT and BI values. By comparison, BFC samples had no metrics above the fully supporting threshold values, and the BFC 2 EPTT value was non-supporting. Of the 11 HC stations sampled, six also had non-supporting EPTT values, all of which were in the urban reach (HC 1-HC 6). Of the urban sites, only HC 4 and HC 6 had partially supporting EPTT values.

Rural HC mean TR values (77) were considerably higher than either the urban HC reach (66) or BFC (69) (Figure 6). Rural HC and BFC EPTT mean values were similar (12 and 11, respectively), and both were higher than the HC urban reach (8) (Figure 7). Mean BI values were highest among rural HC stations (6.7) and lowest among BFC samples (6.4). Urban HC stations had a mean BI value (6.5) between the other two groupings. Mean SDI was highest among rural HC stations (3.20) and lowest at BFC (2.87). Urban mean SDI was between the other groupings at 3.07.

Table 16
Fall 2015 Hinkson Creek Riffle/Pool versus Glide/Pool Macroinvertebrate Composition

↓Variable	Station→	Riffle/Pool			Glide/Pool	
		1	2		1	2
Taxa Richness		77	73		72	67
Number EPT Taxa		16	15		12	13
% Ephemeroptera		17.6	21.2		10.3	13.9
% Plecoptera		0.0	0.0		0.0	0.0
% Trichoptera		18.3	12.4		0.8	0.4
MSCI Score		20	16		14	18
% Dominant Families						
Chironomidae		46.3	45.4		71.1	62.6
Hydropsychidae		17.1	11.3		0.2	0.1
Baetidae		10.7	11.1		<0.1	0.1
Simuliidae		5.3	<0.1		0.8	3.4
Coenagrionidae		3.7	1.2		5.0	1.7
Pisidiidae		<0.1	4.6		0.1	6.3
Heptageniidae		3.1	4.3		4.6	6.5
Corbiculidae		0.2	4.0		0.4	4.1
Caenidae		3.0	1.8		4.3	3.8
Tubificidae		1.6	1.7		2.6	0.7
Ancylidae		1.9	0.9		2.6	1.2

Although many of the macroinvertebrate community attributes were similar between HC and BFC stations, there were several differences (Table 8). One notable difference between HC and BFC was with respect to the abundance and diversity of stoneflies. With the exception of HC 3.5, where a single perlid was present, no stoneflies were collected in samples in the urban HC reach. Although stoneflies were more abundant in rural HC samples, they were still fairly rare, and only one station (HC 6.5) had more than a single taxon. Whereas HC 8 had the highest percentage of stoneflies among all Hinkson Creek stations (0.8 percent), stoneflies made up 2.2 and 1.2 percent of BFC 1a and BFC 1b samples, respectively. Additionally, BFC 1a had four stonefly taxa, and BFC 1b had five taxa. Although stoneflies made up only 0.2 percent of the BFC 2 sample, three taxa were represented. Three of the top five dominant families (Chironomidae, Tubificidae, and Elmidae) were common to both streams, but BFC had a few dominant taxa that either were absent from HC samples or present in very low numbers. Crustaceans in the family Asellidae (isopods) and Crangonyctidae (a family of amphipods) were among the top five dominant taxa at both BFC stations, but they were represented by no more than a few individuals in HC samples.

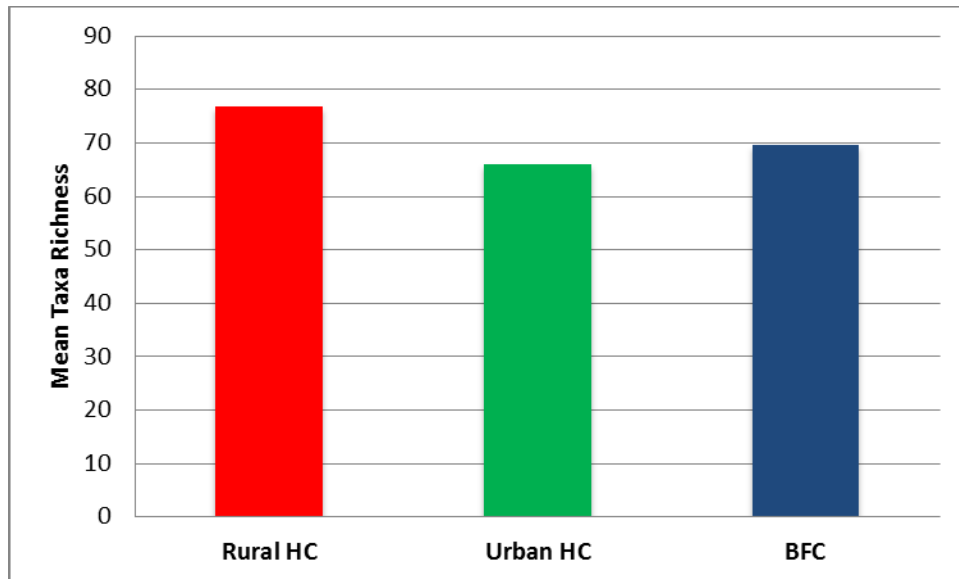


Figure 6. Mean Taxa Richness at Rural Hinkson Creek, Urban HC, and Bonne Femme Creek in Spring 2015 samples.

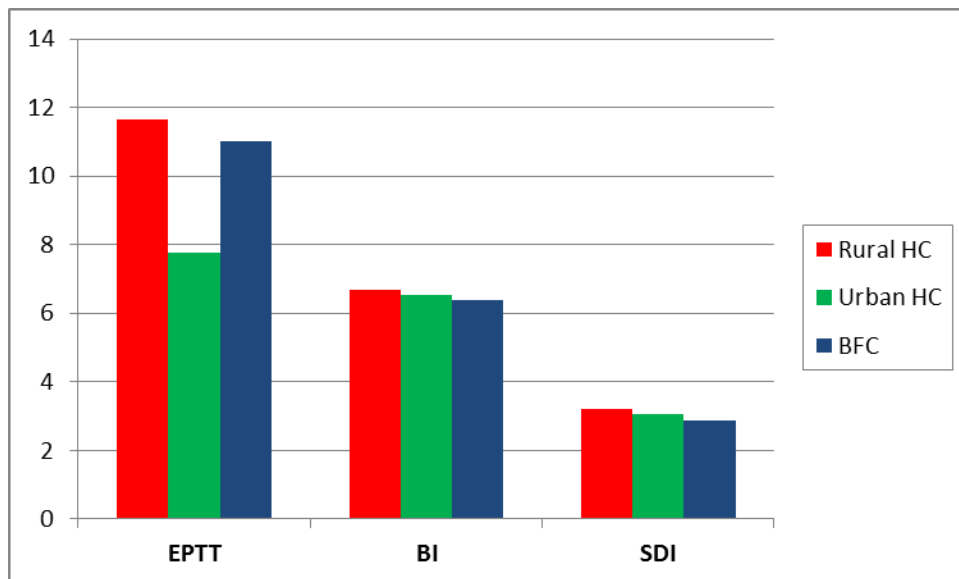


Figure 7. Mean EPTT Richness, Biotic Index, and Shannon Diversity Index values at Rural Hinkson Creek, Urban HC, and Bonne Femme Creek in Spring 2015 samples.

Fall 2015

Both BFC stations had fully supporting MSCI scores in fall 2015 (Table 9). BFC 1 had an MSCI score of 18; the only suboptimal metric score was for EPTT. TR and EPTT both were suboptimal at BFC 2, but the station attained a fully supporting MSCI score of 16. Only one rural HC station was sampled in fall 2015, and it attained a fully supporting MSCI score of 16. Of the eight urban HC stations sampled, six had fully supporting scores ranging between 16 and 20.

In comparing mean values of biological metrics, it should be noted again that the rural HC reach included only a single sample from HC 6.5. There was little variation among mean TR values. The mean TR for the urban HC reach and BFC were 72 and 73, respectively. HC 6.5 had a slightly lower TR value of 70 (Figure 8). Mean EPTT values were similar among the three sample reaches (Figure 9), with HC 6.5 being slightly higher (14) than the urban HC (13) reach or BFC (11). Mean BI values were highest in the urban HC reach (6.7), but there was little difference among the three reaches. Mean SDI values were nearly identical among the urban HC and BFC sites (3.36 and 3.33, respectively). HC 6.5 had a slightly higher SDI value with 3.48.

Compared to spring samples, there was more variability in dominant taxa among sites in the fall (Table 10). Chironomids and hydropsychid caddisflies were abundant at both BFC sites and nearly all HC sites. Although not consistently among the top five taxa, baetid mayflies also were common among BFC and most HC sites. The family Hyalellidae (an amphipod) was present in greater abundance in BFC samples compared to the urban HC reach. This family, made up exclusively of *Hyalella azteca*, was particularly abundant at BFC 1, making up nearly 10 percent of the sample. Although there were a few isolated incidents of taxa being unusually abundant in individual samples (e.g. the biting midge subfamily Ceratopogoninae being nearly 10 times more numerous at HC 2 than any other sample) there were no notable distinctions to be made between the BFC and HC fall macroinvertebrate community.

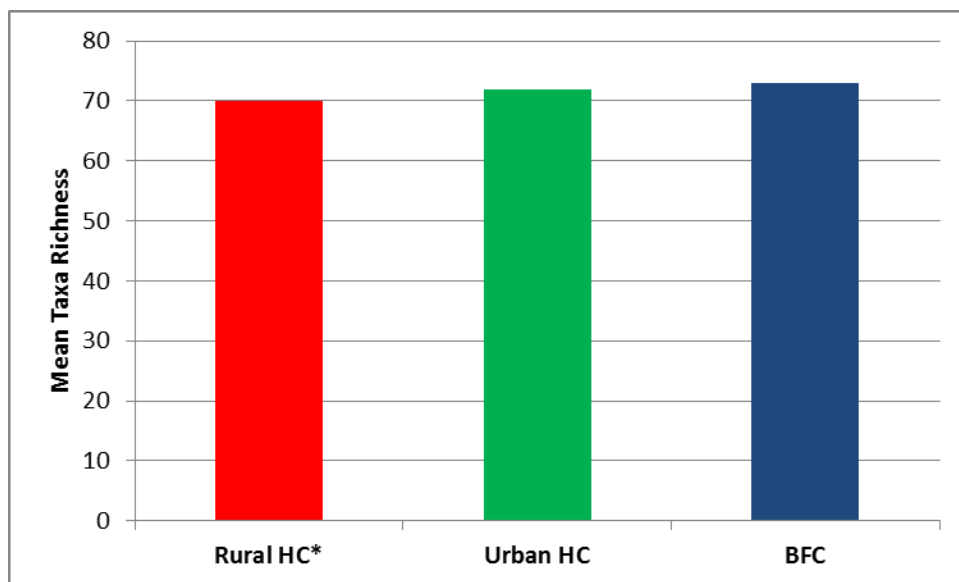


Figure 8. Mean Taxa Richness at Rural Hinkson Creek, Urban HC, and Bonne Femme Creek in Fall 2015 samples. *Only one sample was collected from the rural HC reach.

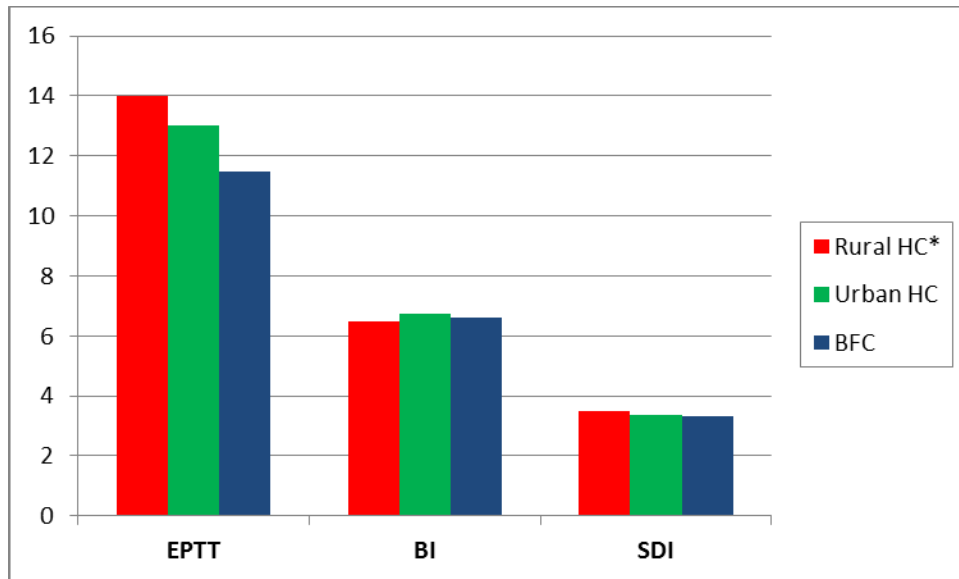


Figure 9. Mean EPTT Richness, Biotic Index, and Shannon Diversity Index values at Rural Hinkson Creek, Urban HC, and Bonne Femme Creek in Fall 2015 samples. *Only one sample was collected from the rural HC reach.

5.2.5 Comparison of 2015 Data and Historical Data

Cumulative Analysis

This section serves to update trend information initiated with the 2012 HC biological assessment (MoDNR 2013a). The data used in the calculations presented in this section exclude samples that may have been affected by drought conditions and samples for which all three habitats were not available.

With the addition of 2015 samples, 20 of 23 (87 percent) rural samples and 30 of 64 (47 percent) of urban HC samples have achieved fully supporting status since the fall of 2001. Since 2012, the percentage of rural streams that have attained fully supporting status has declined from 100 percent to 87 percent, but the urban percentage has increased from 40 to 47 percent (Table 17).

Table 17
Hinkson Creek Percent Fully Supporting Scores

Land Use Segment	pre-2012		2012		2013		2014		2015	
Rural	100	7/7	100	10/10	92.3	12/13	84.2	16/19	87.0	20/23
Urban	35.0	7/20	40.0	10/25	45.5	15/33	47.9	23/48	46.9	30/64

Note: Numbers in the shaded column indicate the cumulative ratio of fully supporting to total number of samples.

The spring 2015 samples had a pattern of rural versus urban in terms of impairment. Whereas all of the rural HC stations had fully supporting MSCI scores, only a single sample collected in the urban reach was fully supporting (Table 18). The fall 2015 samples did not repeat this pattern, with all but two of the urban stations attaining fully supporting status. Rural HC stations continue to have higher mean TR and EPTT values compared to the urban reach, regardless of whether the sample data are segregated by season or grouped. Mean BI values are slightly lower among rural samples, but mean SDI values are nearly the same regardless of season (Tables 19-21). Each of the values calculated in Tables 19-21 are cumulative averages that include data from each of the previous years. As with previous HC reports, samples affected by drought or sparse habitat were not included in calculations.

Metric averages for combined seasons in Table 19 include 23 rural and 64 urban samples collected between 2001 and 2015. With the addition of 2015 data, TR and EPTT declined slightly in the rural reach. In the urban reach, mean TR also declined, but EPTT remained unchanged. Mean BI and SDI values also were unchanged in both sample reaches.

Tables 20 and 21 present metric averages separated by season. Spring samples in the rural reach showed either no or small changes for all four biological metrics. Spring 2015 data resulted in the cumulative mean TR for the urban reach to decline to the lowest point of the study period. Mean EPTT also decreased, but only marginally; the remaining metrics, BI and SDI, were mostly unchanged. Fall 2015 samples resulted in a lower mean TR for both the rural and urban reach. Mean EPTT also decreased in the rural reach, but it increased slightly in the urban reach. Mean BI values were slightly lower in both the rural reach and urban reaches. Mean SDI values were slightly higher in both reaches.

With the addition of the 2015 data, there continues to be a greater disparity between the rural and urban sample reaches for TR and EPTT in fall compared to spring. In spring there is a difference of 5.1 in mean TR between rural and urban, but in fall the difference is 8.4. There is also a greater difference in mean EPTT between the rural and urban reach in the fall. The difference in mean EPTT between reaches is 3.9 for spring and 4.2 for fall data. There continues to be no appreciable difference between sample reaches for the BI or SDI metrics within seasons. Individual values for each of the four biological metrics making up the means presented in Tables 19, 20, and 21 are presented in Appendix C.

Table 18
MSCI Scores in Samples from All Hinkson Creek Stations, Fall 2001-Fall 2015

Station	Land use segment	F01	S02	F03	S04	S05	F05	S06	S12	F12	S13	S14	F14	S15	F15
HC 8 – Rogers Rd.	Rural	12	16 [†]						18		14	16	18	16	
HC 7 – Hinkson Cr. Rd.	Rural	12	16 [†]	18	16 [†]	16	18		16		16	14	20	16	
HC 6.5 – Hwy 63 Connector	Rural				16				16		16	14	18	16	16
HC 6 – E. Walnut St.	Urban	12	10 [†]	16	14	18	16 [†]		14	12	16	14	20	16	18
HC 5.5 – Broadway	Urban			14 ^{††}	16	16	12 [†]		16	16	16	16	18	12	16
HC 5 – Upstr. of Grindstone	Urban	16	10 [†]						16	10	16	12	20	12	14
HC 4 – Dwnstr. of Grindstone	Urban	18	12 [†]						16	12	16	16	18	14	14
HC 3.5 – Recreation Dr.	Urban					12 [†]	12 [†]		14	12	16	16	14	12	16
HC 3 – Forum Blvd.	Urban	16 [†]	12 [†]					16		12	10	12	14	12	16
HC 2 – Twin Lakes RA	Urban	14 ^{††}	12 [†]					12 [†]		14	14	12	16	12	16
HC 1 – Scott Blvd.	Urban	14 ^{††}	14					14 ^{††}		14	12		14	12	20

Shaded cells indicate that the sample did not attain fully supporting status. Cross-hatched cells indicate that only two of three habitats were fully represented. Numbers that have been stricken through indicate those that were excluded due to drought or habitat limitation effects. Blank cells represent seasons/stations in which no samples were collected.

[†]MSCI scores that are lower than original bioassessment report due to updated biological criteria for the Ozark/Moreau/Loutre EDU.

^{††}Samples with MSCI scores that changed from fully supporting to partially supporting due to updated biological criteria.

Table 19
Mean Values for Individual MSCI Metrics at Hinkson Creek Stations for Combined
Sample Seasons 2001-2015

Biological Metric	Rural (HC 6.5, 7, and 8)					Urban (HC 1 – 6)				
	<2012	2012	2013	2014	2015	<2012	2012	2013	2014	2015
Taxa Richness	78.6	78.0	77.4	79.7	78.9	73.1	72.9	73.7	75.1	73.6
EPTT Richness	15.4	14.5	14.1	14.3	13.9	9.5	9.7	9.6	10.3	10.7
Biotic Index	6.9	6.7	6.7	6.6	6.6	7.0	7.0	7.0	7.0	6.8
Shannon Diversity	3.10	3.11	3.12	3.10	3.12	3.10	3.11	3.08	3.11	3.15
Number of Samples	7	10	13	19	23	20	25	33	48	64

Table 20
Mean Values for Individual MSCI Metrics at Hinkson Creek Stations, Spring Samples
2002-2015

Biological Metric	Rural (HC 6.5, 7, and 8)					Urban (HC 1 – 6)				
	<2012	2012	2013	2014	2015	<2012	2012	2013	2014	2015
Taxa Richness	77.8	77.4	76.8	76.8	76.8	72.1	72.1	73.4	73.2	71.7
EPTT Richness	14.8	13.9	13.5	13.3	13.0	8.9	9.3	9.3	9.4	9.1
Biotic Index	6.7	6.6	6.6	6.6	6.6	7.0	7.0	7.0	7.0	6.9
Shannon Diversity	3.03	3.07	3.10	3.04	3.07	3.05	3.08	3.05	3.05	3.05
Number of Samples	5	8	11	14	17	12	17	25	32	40

Table 21
Mean Values for Individual MSCI Metrics at Hinkson Creek Stations, Fall Samples
2001-2015

Biological Metric	Rural (HC 6.5, 7, and 8)					Urban (HC 1 – 6)				
	<2012	2012	2013	2014	2015	<2012	2012	2013	2014	2015
Taxa Richness	81.5	*	*	88.4	85.3	75.6	*	*	79.4	76.9
EPTT Richness	17.0	*	*	17.2	16.7	10.5	*	*	12.3	12.5
Biotic Index	7.2	*	*	6.7	6.6	7.1	*	*	7.0	6.9
Shannon Diversity	3.27	*	*	3.22	3.26	3.19	*	*	3.23	3.27
Number of Samples	2	*	*	5	6	8	*	*	16	24

*Samples collected in fall 2012 were not included due to effects of drought conditions;
samples were not collected in fall 2013 due to drought.

Comparison of Pre- versus Post-CAM Macroinvertebrate Metrics

As previously mentioned, the historical data trends presented in Tables 19-21 are cumulative, and sample data included in calculations of mean values date back to the earliest samples collected in 2001 and 2002. In this section, Tables 22-24 present mean biological metric data that are segregated into two groups: before the CAM study agreement (those data collected between 2001 and 2006) and sample data collected between 2012 and 2015. Results of statistical analyses used to generate the *p*-values listed in Tables 22-24 are presented in Appendix D.

Although there were several differences between data sets within individual groupings, few statistically significant differences exist. With data combined from both sample seasons, mean BI for the recent data set was significantly lower for both the rural ($p=0.026$) and urban ($p=0.001$) sample reaches (Table 22). For the remaining biological metrics, there were no significant differences between older data and sample data collected thus far for the CAM project.

Table 22
Pre-CAM vs. Post-CAM Mean Biological Metric
Values, Combined Seasons

Biological Metric	Rural (HC 6.5, 7, and 8)			Urban (HC 1 – 6)		
	<2012	≥2012	<i>p</i> -value	<2012	≥2012	<i>p</i> -value
Taxa Richness	78.6	79.1	0.891	73.1	73.7	0.730
EPTT Richness	15.4	13.3	0.059	9.5	10.7	0.227*
Biotic Index	6.9	6.5	0.026*	7.0	6.8	0.001*
Shannon Diversity	3.10	3.13	0.648	3.10	3.15	0.389
Number of Samples	7	16		20	44	

*Mann-Whitney Rank Sum Test; *p*-values in shaded cells indicate statistical significance.

When spring data were analyzed separately (Table 23), the only significant difference was in the rural EPTT metric. The recent data for this metric was significantly lower ($p=0.010$) than the older data considered (Table 23). Although recent mean TR and BI values were lower than older data, the differences were not significant for either rural ($p=0.626$) or urban ($p=0.811$) samples.

Table 23
Pre-CAM vs. Post-CAM Mean Biological Metric
Values, Spring Season

Biological Metric	Rural (HC 6.5, 7, and 8)			Urban (HC 1 – 6)		
	<2012	≥2012	<i>p</i> -value	<2012	≥2012	<i>p</i> -value
Taxa Richness	77.8	76.3	0.626	72.1	71.6	0.811
EPTT Richness	14.8	12.3	0.010	8.9	9.1	0.839
Biotic Index	6.7	6.6	0.387	7.0	6.8	0.172
Shannon Diversity	3.03	3.09	0.513	3.05	3.06	0.879
Number of Samples	5	12		12	28	

p-values in shaded cells indicate statistical significance.

When fall data were analyzed separately (Table 24), there was a relatively large difference in mean rural TR ($\Delta=5.8$), but the difference was not statistically significant ($p=0.567$). The only rural biological metric that had a significant difference between the two time periods was BI ($p=0.006$). Among the fall urban metrics, the recent mean EPTT value was significantly higher than pre-CAM values ($p=0.013$). The recent mean BI value was significantly lower than the mean of older values ($p=0.023$).

Table 24
Pre-CAM vs. Post-CAM Mean Biological Metric
Values, Fall Season

Biological Metric	Rural (HC 6.5, 7, and 8)			Urban (HC 1 – 6)		
	<2012	≥2012	<i>p</i> -value	<2012	≥2012	<i>p</i> -value
Taxa Richness	81.5	87.3	0.567	75.6	77.6	0.554
EPTT Richness	17.0	16.5	0.780	10.5	13.6	0.013
Biotic Index	7.2	6.4	0.006	7.1	6.8	0.023
Shannon Diversity	3.27	3.25	0.854	3.19	3.31	0.043*
Number of Samples	2	4		8	16	

*Mann-Whitney Rank Sum Test; *p*-values in shaded cells indicate statistical significance.

Comparing MSCI scores in the pre-CAM versus post-CAM time periods showed a decrease in the percentage of fully supporting scores in the rural reach (Table 25). The percentage of fully supporting scores in the urban reach, however, increased notably from the earlier to the latter time period.

Table 25
Pre-CAM vs. Post-CAM MSCI Scoring Categories

	Rural MSCI Scores				Urban MSCI Scores			
	2001-06		2012-15		2001-06		2012-15	
Full Support	100%	7	81.3%	13	38.1%	8	52.3%	23
Partial Support	0%	0	18.7%	3	61.9%	13	47.8%	21
Number of Samples		7		16		21		44

6.0 Discussion

6.1 Physicochemical Data

Spring 2015

Spring 2015 water quality samples were collected five days after a moderately high flow event that likely led to higher turbidity readings and TSS values than what are typical for this time of year. These higher flows also likely resulted in slightly lower conductivity readings compared to past bioassessments (e.g. 2014 data MoDNR 2016a) as ionic compounds in the stream were diluted.

The presence of sulfate in HC surface water samples is likely related to past coal mining activity in the upper HC watershed (USGS 1982). Coal mine drainage in Missouri has been documented to increase the sulfate concentration of receiving streams (Blevins 1986), due to the sulfur content of central Missouri coal (undated MoDNR publication). The majority of HC samples had sulfate concentrations that were high enough to require dilution during laboratory analysis. This condition also occurred with 2013 and 2014 spring water chemistry samples (MoDNR 2014a, 2016a); sulfate was not included in the standard suite of chemical parameters prior to 2013. Although HC sulfate concentrations were several times higher than those of BFC, they were well below the WQS (MoDNR 2014b).

Chloride concentrations tended to increase steadily from upstream to downstream, including HC 8 to HC 3.5. The three downstream stations (HC 1 to HC 3) all had chloride concentrations that were higher than HC 3.5 but similar to one another. This observation is consistent with observations made by Hubbard et al. (2017), who noted that soils and groundwater in the HC watershed can, under certain conditions, serve as a source of chloride in HC. The likely ultimate source of chloride accumulation over time is via salt application to roads and parking lots during the winter months. Although the chloride concentrations noted in this study were much lower than USEPA chronic (230 mg/L averaged over four days) or acute (860 mg/L average concentration over one hour) levels, Hubbard et al. (2017) made observations of chronic chloride concentrations at all of their monitoring stations except Rogers Road (HC 8 in this study). Hubbard et al. (2017) also observed acute chloride concentrations, although at fewer stations and fewer numbers of days. These observations indicate that the macroinvertebrate community of HC is subjected to repeated, although sporadic, chronic (and sometimes acute) chloride concentrations throughout the urban reach.

The nutrient parameters $\text{NO}_3+\text{NO}_2\text{-N}$, TN, and TP were highest at HC 7 and 8, which is consistent with recent past bioassessments (2014 and 2013 spring data). It is possible that fertilizers used on croplands in the upper watershed contribute to these nutrient concentrations. Because Missouri has not yet adopted nutrient criteria, HC and BFC nutrient concentrations are compared to USEPA Level III Ozark Highlands recommended reference concentrations (USEPA 2000). None of the HC $\text{NO}_3+\text{NO}_2\text{-N}$ levels exceeded the recommended concentration of 0.24 mg/L for this ecoregion of Missouri. Spring TN concentrations, however, exceeded the USEPA recommended concentration (0.38 mg/L) at all HC stations. The duplicate BFC samples were below the USEPA TN recommended concentration. The TP concentrations for all HC and BFC samples exceeded the USEPA recommended level (0.001 mg/L). Given the mixed land use of both watersheds, it is not surprising that at least some nutrient values exceeded USEPA recommended concentrations, which were based on 25th percentile values of Ozark streams that “represent the...best attainable, or most natural condition of the resource base at this time” (USEPA 2000).

Fall 2015

Fall 2015 water quality samples were collected during very low flows at both HC and BFC stations. Because there was no surface flow through the riffle habitat at HC 7 and 8, neither macroinvertebrate nor water chemistry samples were collected in the fall. One notable feature of fall water quality was that the HC 2 dissolved oxygen concentration (4.93 mg/L) was slightly below the 5 mg/L minimum specified in the WQS (MoDNR 2014b). It is unclear why this station would have dissolved oxygen concentrations that were lower than the other sites that bracket it. HC 2 has similar characters that have the potential to affect dissolved oxygen as HC 1 (e.g. canopy cover, low flows), but HC 1 had dissolved oxygen concentrations well above the WQS threshold. Given that HC 1 was sampled earlier in the morning (with less time for photosynthesis to generate oxygen at this site), it would be expected that HC 1 would have had dissolved oxygen concentrations similar to or lower than HC 2, other factors being equal. As such, there was no obvious reason to explain the low dissolved oxygen observed at HC 2.

Unlike spring samples, sulfate concentrations tended to be higher among upstream stations in fall. HC 4, 5, 6, and 6.5 each required dilution during sulfate laboratory analysis. Layers of coal are intermittently visible in the streambanks of the upstream HC stations. The higher concentrations of sulfate among some of the upstream stations may be the result of shallow groundwater coming in contact with these coal seams carrying sulfate into the creek. It is likely that the low flow conditions in fall 2015 led to less dilution of some chemical constituents among stations.

Higher chloride concentrations in urban streams are typically associated with late winter and early spring conditions as snow melts and spring rains carry road treatment chemicals into receiving streams (Hubbart et al. 2017). In this study, however, fall 2015 chloride concentrations were slightly higher than spring at all HC stations except HC 1 and 2. As was the case with sulfate concentrations discussed above, drought conditions may have

had an effect on chloride concentrations as well. Hubbard et al. (2017) described conditions in HC whereby relatively high chloride in soils and shallow groundwater can increase chloride concentrations in the creek itself, particularly when there are insufficient flows in HC for dilution.

Nutrient concentrations in fall demonstrated no longitudinal patterns among HC stations. TN concentrations were near the USEPA recommended threshold of 0.38 mg/L at most stations, but only HC 5.5 and BFC 1a exceeded this value. The highest NO₃+NO₂-N concentration occurred at HC 5.5 (0.11 mg/L), but this value was less than half of the USEPA recommended concentration (0.24 mg/L). All HC and BFC samples exceeded USEPA's recommended TP concentration of 0.001 mg/L. The values of each of the nutrient parameters was lower in fall 2015 compared to fall 2014 (MoDNR 2016a). Given that fall 2014 flow ranged from 4.2 cfs at HC 8 to 43.3 cfs at HC 1, it is likely that the low flows in fall 2015 (0.2 to 1.4 cfs) resulted in these relatively low nutrient concentrations.

6.2 Biological Assessment

6.2.1 Hinkson Creek Longitudinal Comparison

Spring 2015

Four of the 11 HC stations sampled in spring 2015 attained fully supporting MSCI scores. Only one of these HC stations (HC 6) was downstream of Interstate 70 in what is considered the urban reach. The low proportion of fully supporting scores was unexpected, given that the majority of fall 2014 MSCI scores were fully supporting (MoDNR 2016a), and the fall and winter months prior to spring 2015 sampling were characterized by adequate flows that should have been beneficial to macroinvertebrate community maintenance. Despite few heavy precipitation events, the USGS gaging station at Providence Road (USGS gage #06910230) indicates that between the fall 2014 and spring 2015 sample seasons, HC experienced only a few days of low flows (no readings below 2.70 cfs) in November 2014. During the remainder of the winter and early spring, HC flows were seemingly nominal. This same time period also experienced a relatively mild winter, with average daily temperatures rarely falling below freezing (Missouri Historical Agricultural Weather Database available for query at <http://aes.missouri.edu/sanborn/weather/sanborn.stm>). There was very little snow during the months preceding spring 2015 sampling as well, with the heaviest snow event (0.37 inches) occurring on February 28, 2015 (Weather Underground query for the Columbia Regional Airport <https://wunderground.com/history/airport/KCOU>). Based on these weather trends, it is unlikely that road salt application and subsequent runoff would have been a major factor in spring 2015 biological metric scores.

Chironomids were the dominant taxa group of all HC and BFC stations in spring 2015. Although it is not unusual for chironomids to be dominant among spring HC samples, there has generally been some longitudinal variability (e.g. chironomids occurring in lower percentages among upstream samples). In spring 2015, however, the percentage of chironomids making up samples was fairly consistent among all samples, including BFC.

This percentage, however, was exceptionally high compared to the mean among BIOREF samples. Tubificid worms, which are generally a tolerant taxa group, also were in the top five abundant taxa at all HC and BFC sites, but their percentages were more similar to BIOREF abundance. On average, mayflies and stoneflies make up a sizeable contribution to BIOREF samples in the Ozark/Moreau/Loutre EDU (28.9 percent and 9.1 percent, respectively); however each of these taxa groups was comparatively rare in HC and BFC samples. Although the cause was not obviously apparent, spring 2015 samples were marked by a rarity of sensitive taxa (mayflies and stoneflies) and an overwhelming abundance of chironomids.

Fall 2015

Although central Missouri was experiencing drought conditions in the weeks preceding the fall 2015 sample season, flows were adequate for sampling all habitats at nine of the 11 HC stations and both BFC sites. Despite low flow conditions, seven HC stations had fully supporting MSCI scores, and both BFC sites were fully supporting.

Chironomids were the dominant taxa group at all HC and BFC sites in fall 2015, but unlike spring samples, chironomid abundance was closer to the average among BIOREF samples. Fall samples also had a higher percentage of intolerant taxa groups (mayflies and caddisflies) compared to spring to the extent that several HC stations had similar percentages of these groups as averages among BIOREF samples. Despite the fact that several HC stations had mayfly and caddisfly percentages similar to BIOREF samples, the number of taxa within these groups was at or below the EPTT threshold value for the majority of HC and both BFC samples. Only two stations (HC 1 and HC 6) had fully supporting EPTT scores.

6.2.2 Hinkson Creek Station 1 and Station 2 Riffle/Pool versus Glide/Pool Data Comparison

Habitat and flow regime of HC 1 and HC 2 exhibit certain differences compared to the remaining upstream HC stations. HC 1 is occasionally subjected to back water effects when the Missouri River stage is sufficiently high to cause lower Perche Creek (the HC receiving stream) to cease flow, which in turn results in a cessation of flow at HC 1. Additionally, both HC 1 and HC 2 appear to have lower gradient and less favorable (and less abundant) riffle habitat compared to stations upstream.

For samples collected between 2001 and 2014, HC 1 and HC 2 consistently have had partially supporting MSCI scores. Of the 11 samples collected at these two sites in this time period, only one sample at HC 2 attained fully supporting status. The extent to which differences in gradient, flow regime, and riffle habitat quality affect the macroinvertebrate community and biological metric scores is unknown. To address this issue, HC 1 and HC 2 were sampled using protocols designed for both riffle/pool (Ozark-type streams) and glide/pool (prairie-type streams) dominant habitats during the 2015 study period.

Spring 2015

Although glide/pool TR, EPTT, and SDI biological metric thresholds are notably lower than riffle/pool criteria, the two sampling regimes resulted in identical support rankings in spring 2015. The glide/pool EPTT threshold was the only metric to result in a higher individual metric score (from a non-supporting score of 1 to a partially supporting score of 3) for both HC 1 and HC 2. The two sample regimes yielded very similar metric values, and there were few notable differences in macroinvertebrate community composition.

Fall 2015

Unlike the spring, there were differences between the sampling regimes in fall 2015 results. The most notable difference was with MSCI scoring of HC 1, which attained the highest possible score of 20 using the riffle/pool protocol but a partially supporting score of 14 with glide/pool methods. With the exception of TR, each of the metrics in the HC 1 glide/pool sample attained partially supporting scores. In contrast, HC 2 attained a slightly higher MSCI score using glide/pool criteria, but both sample regimes resulted in fully supporting status. Macroinvertebrate community composition had several differences between sample regimes. Whereas chironomids were present in much higher percentages in the glide/pool sample, mayflies were much less abundant and caddisflies were nearly absent compared to the riffle/pool sample.

Based on this one year of comparative data, no definitive trends are present. It was surprising, however that HC 1 riffle/pool sample attained a higher MSCI score of 20 in fall 2015 compared to the glide/pool, especially considering that prior to fall 2015 this station had never attained a fully supporting score. One factor is apparent, however: changing from a riffle/pool to a glide/pool sampling regime did not result in a dramatic improvement in 2015 MSCI scores.

6.2.3 Comparison of Hinkson and Bonne Femme Creeks

Spring 2015

Each of the three rural HC stations attained fully supporting MSCI scores in spring 2015; however, all three samples collected from BFC were partially supporting. Rural HC stations had higher TR values compared to the BFC sites, but EPTT and BI values were roughly similar. Samples collected in the urban reach, however, had lower average TR and EPTT values than either the rural HC stations or BFC. Although all HC stations had higher SDI values compared to BFC, the difference between BFC and the rural HC reach was greater.

There were few macroinvertebrate community differences between BFC and rural HC in spring samples. Three of the five dominant taxa were the same between most BFC and HC sites (Chironomidae, Tubificidae, and Elmidae), but BFC had two taxa that were either extremely rare or absent in HC samples. Asellidae (aquatic sow bugs) and Crangonyctidae (an amphipod) were abundant at BFC 1 and among the top five dominant taxa at BFC 2 (although at a lower percentage). Each of these taxa groups is fairly

tolerant to organic pollutants, having BI values of 8. Stoneflies were more abundant in the BFC 1 duplicate samples than the rural HC sites; however, at BFC 2 stoneflies were present in percentages similar to or lower than the rural HC sites.

Overall, BFC spring samples resulted in biological metric and MSCI scores that were similar to or, in the case of BFC 2, lower than HC samples. Most macroinvertebrate community attributes indicate that the BFC sites were not notably different compared to HC. The only feature that would suggest a difference in water quality effects between the two systems is the higher relative abundance and diversity of stoneflies at BFC 1 compared to HC. The stonefly taxa that were present in BFC samples had BI values that ranged between 0 and 2, which is indicative of taxa that are extremely sensitive to organic pollutants.

Fall 2015

Both BFC stations attained fully supporting MSCI scores in fall 2015, as did the majority of HC stations. Compared to the single rural HC station sampled, the BFC sites tended to have slightly higher TR, but only BFC 1 was above the fully supporting threshold for this metric. HC 6.5, however, had a slightly higher EPTT value than either BFC site; however neither was in the fully supporting range. The remaining biological metrics, BI and SDI, were above the fully supporting threshold for both BFC stations and HC 6.5. Average TR values were nearly identical among rural HC, urban HC, and BFC samples; however, BFC samples had the lowest average EPTT among the three groupings in fall.

BFC and most HC stations had similar percentages of mayflies in the fall sample, and stoneflies were absent from both systems. Caddisfly relative abundance was extremely variable among HC stations, but five of the nine HC stations had caddisfly abundance that was roughly similar to the BFC samples. The majority of dominant taxonomic families were similar among HC and BFC samples. One exception was that the family Hyalellidae (an amphipod) was much more abundant among the two BFC samples than HC. Because this taxa group is moderately tolerant of organic pollution, its abundance in one watershed versus the other is not necessarily indicative of a difference in water quality.

6.2.4 Comparison of 2015 Data and Historical Data

Sample data collected in 2015 were compared to past historical data using several different perspectives. In the cumulative analysis of fully supporting scores, a running total of samples was used to demonstrate how the percentage of fully supporting scores has changed incrementally during each successive sample year. This method of comparison also was used on each of the four primary biological metrics. To gauge the effects of data age, pre-CAM “baseline” data were compared with data collected during the CAM biological assessment phase.

Cumulative Analysis

The inclusion of 2015 sample data resulted in an increase in the percentage of rural HC stations with fully supporting MSCI scores compared to the previous year and a slight decrease in the urban percentage. The high number of partially supporting spring 2015 MSCI scores in the urban reach resulted in this decline. Taxa Richness and EPTT average values declined with the inclusion of the 2015 data in nearly every data subset (spring season, fall season, and combined). The difference in biological metrics between the rural and urban reach was notable for TR and EPTT for both sample seasons; reach differences for BI and SDI were much less prominent, regardless of season.

These rural versus urban trends with TR and EPTT suggest that the macroinvertebrate community is generally less diverse and more tolerant in the urban reach and there does not appear to be taxa replacement in the urban reach as sensitive groups become less diverse and abundant. This observation is consistent with Paul and Meyer (2001) who, by way of literature review, concluded that urban streams tend to exhibit decreases in sensitive macroinvertebrates (e.g. those represented by the EPT taxa metric), an increase in chironomids, oligochaetes, and tolerant gastropods, as well as an overall decrease in invertebrate abundance. Walsh et al. (2005) cited multiple studies that reported attributes of macroinvertebrate communities of “highly degraded” urban streams. These urban settings had communities in which sensitive taxa were less abundant or absent, reduced taxa richness, and an abundance of relatively few tolerant taxa. Although Hinkson Creek does not have all of the attributes that Walsh et al. (2005) listed as making up a “highly degraded” urban system (such as wastewater effluent, habitual combined or sanitary sewer overflows), it is likely that differences in mean TR and EPTT values over time between the rural and urban sample reaches are due to other, more subtle, urban effects such as changes in hydrologic and thermal regimes and water quality analytes (e.g. chloride) observed over time.

Comparison of Pre- versus Post-CAM Macroinvertebrate Metrics

As mentioned in Section 1.0, the decision to undertake a multi-year biological assessment as part of the CAM process was at least partly intended to gauge the current condition of HC with the collection of a more recent set of data. This section of the report compares MSCI scores and biological metric values of older data (2001-2006) with sample data collected between 2012 and 2015. Rural and urban data sets were analyzed separately.

Although differences did exist between the two data sets, analysis resulted in few statistically significant differences. Only BI had a significant difference when spring and fall data were combined. When seasons were analyzed separately, the difference in average spring BI values was not statistically different; however, the difference in fall BI values was. Average BI values from the recent data set were significantly lower than earlier data, which suggests that the current HC macroinvertebrate community comprises a higher proportion of sensitive individuals compared to the past. It should be noted that the current average urban BI value (BI=6.8 for all data sets) now equals the metric threshold value (separating partial support from full support) for fall

Ozark/Moreau/Loutre EDU biological criteria. Average spring BI values, however, are farther from the threshold value (spring BI threshold value=6.4).

The statistical significance of the lower average urban BI fall values may be linked to the statistically significant increase in average EPTT values. In general EPT taxa are among the most sensitive in a given macroinvertebrate community, and the increase observed with the recent data set likely contributed to the lower average fall BI value among urban samples. The current average urban fall EPTT value (EPTT=13.6) is much closer to the fall metric threshold value (EPTT=15), but the spring average for the urban reach (EPTT=9.1) is roughly half of the spring threshold value (EPTT=17).

It was interesting to note that, although not statistically significant, the current average spring TR value is slightly lower for both the rural and urban reach. Although both reaches experienced an increase in fall TR values, the difference for the urban reach was slight. Despite a seemingly large increase over time in average fall rural TR ($\Delta=5.8$), the difference between data sets was not statistically significant. Because there are so few fall rural samples available for comparison between time periods (two pre-CAM and four post-CAM), no definitive trends should be inferred, however.

Overall, the current percentage of fully supporting MSCI scores is higher than the 2001-2006 time frame. Although the current percentage of fully supporting scores in the rural reach is lower (declining from 100 to 81.3 percent fully supporting), the percentage is still comparable to Ozark/Moreau/Loutre BIOREF streams (82.6 percent). By conducting additional sampling, there is an increased likelihood of samples reflecting a wider variety of antecedent climatic conditions. It was very unlikely that the suite of rural control stations would have maintained their 100 percent fully supporting status indefinitely. The current percentage of fully supporting MSCI scores (52.3 percent) is notably higher in the urban reach compared to 2001-2006 (38.1 percent); however, it is still much lower than the BIOREF percentage.

7.0 Conclusions

1. Nutrient parameters ($\text{NO}_3+\text{NO}_2\text{-N}$, TN, and TP) were present in higher concentrations among rural HC stations in spring 2015 compared to urban stations.
2. Chloride, sulfate, and hardness concentrations generally tended to increase from upstream HC stations to downstream in spring.
3. Drought conditions resulted in no surface flow in riffles at HC 7 and 8 in fall 2015. No water quality or macroinvertebrate samples were collected at these stations.
4. The dissolved oxygen concentration at HC 2 was below the minimum WQS concentration of 5.0 mg/L in fall 2015.
5. Although $\text{NO}_3+\text{NO}_2\text{-N}$, TN, and TP were present in detectable concentrations among some HC stations, there were no longitudinal patterns associated with these nutrient parameters in fall 2015.

6. Although chloride concentration tended to be higher in fall samples, they were variable and no longitudinal pattern existed.
7. Sulfate concentrations also were variable in fall. Unlike spring samples, sulfate concentrations were higher in upstream samples (HC 4-6.5).
8. Of the 11 HC stations sampled in spring 2015, four attained fully supporting MSCI scores. None of the fully supporting MSCI scores was greater than 16.
9. Each of the three rural stations (HC 6.5-8) was fully supporting, but only one urban station (HC 6) had a fully supporting MSCI score in spring.
10. Three macroinvertebrate samples were collected at BFC, a local control stream. None of the three BFC samples had fully supporting MSCI scores in spring.
11. All urban HC stations and the three BFC samples had sub-optimal TR values in spring. None of the stations sampled had optimal EPTT values, and half (7 of 14) of the samples collected from the two streams had the lowest possible score for the EPTT metric.
12. Of the nine HC stations sampled in fall 2015, seven had fully supporting MSCI scores.
13. HC 1, the farthest downstream station, achieved its first fully supporting MSCI score since studies began in 2001. This station's first fully supporting score was the highest possible (20) in fall 2015.
14. The majority of HC samples had sub-optimal TR and EPTT values. Only HC 1 and 6 had fully supporting values for both of these metrics in fall.
15. HC 1 and 2 were assessed using both riffle/pool (Ozark-type) and glide/pool (prairie-type) sampling protocols and criteria thresholds. Although both stations had higher MSCI scores using glide/pool criteria in spring 2015, they remained in partially supporting status. In fall, however, HC 1 had a fully supporting MSCI score of 20 using riffle/pool criteria but a partially supporting score of 14 with glide/pool criteria. HC 2 had a fully supporting MSCI score of 16 using riffle/pool criteria, and a score of 18 with glide/pool criteria.
16. In comparing rural HC stations to BFC stations, both BFC stations had partially supporting MSCI scores in spring 2015, but the three similarly-sized rural HC stations attained fully supporting scores.
17. In fall 2015, both BFC stations had fully supporting scores. Due to drought conditions, only one rural HC station was sampled. HC 6.5 also attained fully supporting status in fall 2015.
18. With the inclusion of 2015 sample data, the running average for TR decreased slightly. The average EPTT value decreased for the rural reach, but it was unchanged for the urban reach compared to 2014.
19. The running average (including samples collected between 2001 and 2015) of fully supporting MSCI scores increased with the addition of the 2015 data, but the percentage was slightly lower for the urban reach.
20. Statistical analysis of pre-CAM data (2001-2006) versus samples collected as part of the CAM agreement (2012-2015) was included in this report. Average metric values were analyzed by grouping seasons together as well as analyzing seasons separately. Rural samples were analyzed separately from urban samples.

21. With seasons combined, current average BI values are significantly lower than pre-CAM. BI was the only biological metric to have a statistically significant difference between data sets of combined seasons.
22. For spring-only data, the only statistically significant difference was that the current rural average EPTT value is lower than pre-CAM.
23. For fall-only data, current average BI values were significantly lower for both the rural and urban sample reaches. The current average EPTT value was significantly higher than pre-CAM, but only for the urban reach.
24. Statistical analysis was not conducted on pre-CAM versus current MSCI scores. Although the current percentage of fully supporting MSCI scores is lower in the rural reach than pre-CAM, the current percentage is nearly equal to the percent of fully supporting scores among Ozark/Moreau/Loutre BIOREF streams.
25. The current percentage of fully supporting urban MSCI scores is considerably higher than pre-CAM, but it continues to be much lower than BIOREF streams.

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Submitted by:



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Date:

5.16.2019

Approved by:



Lynn Milberg
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LM:dmh

c: Irene Crawford, Regional Director, NERO
Robert Voss, QAPP Project Manager, WPP

Appendix A

Spring 2015 Macroinvertebrate Taxa Lists

Fall 2015 Macroinvertebrate Taxa Lists

Hinkson Creek

Bonne Femme Creek

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15118], Station #1, Sample Date: 3/31/2015 3:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
"HYDRACARINA"				
Acarina		6	1	5
ARHYNCHOBDELLIDA				
Erpobdellidae		2	1	
COLEOPTERA				
Berosus			2	1
Dubiraphia		4		
Macronychus glabratus		1	1	
Stenelmis	13		2	1
DECAPODA				
Faxonius virilis			-99	
Palaemonetes kadiakensis			-99	
DIPTERA				
Ablabesmyia		32	15	1
Ceratopogoninae		10	4	
Chironomidae	9	23	26	24
Chironomus		4	1	
Cladotanytarsus	65	34	4	19
Corynoneura	1	1	4	
Cricotopus bicinctus			1	
Cricotopus/Orthocladius	54	11	25	90
Cryptochironomus	9	4		1
Dicrotendipes	12	4	6	9
Eukiefferiella	1			1
Glyptotendipes		1		
Hydrobaenus	11	8	7	10
Labrundinia		2	11	
Micropsectra	2			
Nanocladius		3	18	1
Ormosia	8			
Paralauterborniella	1	8		
Paratanytarsus		4	1	
Paratendipes	2	6	1	
Phaenopsectra	1	7	9	3
Polypedilum aviceps	1			
Polypedilum fallax grp				3
Polypedilum flavum	133	2	11	68
Polypedilum halterale grp	8	4		
Polypedilum illinoense grp	1		59	12
Polypedilum scalaenum grp	57	8	1	3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15118], Station #1, Sample Date: 3/31/2015 3:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Rheotanytarsus	4	5	15	6
Saetheria	5	27		1
Simulium			1	7
Stempellinella		1	2	
Stictochironomus	13	5		
Tanytarsus	24	48	79	40
Thienemanniella	1	1	5	1
Thienemannimyia grp.	14	3	8	8
Tribelos		1		
Zavreliomyia	2			
EPHEMEROPTERA				
Acerpenna			1	
Caenis latipennis	1	11		
Hexagenia limbata		2		
Stenacron		1		
Stenonema femoratum	3	10		
HEMIPTERA				
Belostoma			-99	
Trichocorixa		1		
LUMBRICINA				
Lumbricina	1			
LUMBRICULIDA				
Lumbriculidae	6			
MEGALOPTERA				
Sialis		2		
ODONATA				
Argia		3		
Enallagma				4
Macromia		1		
TRICHOPTERA				
Cheumatopsyche	2		1	1
TUBIFICIDA				
Branchiura sowerbyi		3		
Enchytraeidae	6	1	2	
Limnodrilus claparedianus			1	
Limnodrilus hoffmeisteri	15	6	2	
Tubificidae	43	37		1
VENEROIDA				
Corbicula		2		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15117], Station #2, Sample Date: 3/31/2015 2:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
"HYDRACARINA"				
Acarina		2	7	
AMPHIPODA				
Crangonyx			1	
ARHYNCHOBDELLIDA				
Erpobdellidae			-99	
BASOMMATOPHORA				
Ancylidae	1			
COLEOPTERA				
Berosus	5	2	-99	
Dubiraphia			3	1
Stenelmis	39	4	1	
DECAPODA				
Faxonius virilis			-99	
DIPTERA				
Ablabesmyia	1	10	10	1
Ceratopogoninae	1	4	3	
Chaoborus				1
Chironomidae	4		1	3
Chironomus	1	20	1	
Cladotanytarsus	32	26	4	2
Corynoneura	2	3	2	1
Cricotopus sylvestris grp	7	1		3
Cricotopus/Orthocladius	83	4	20	77
Cryptochironomus	3	4	1	1
Dicrotendipes	8	2	3	3
Diptera				1
Eukiefferiella	1		2	1
Hemerodromia				1
Hydrobaenus	11	5	9	9
Labrundinia		1	6	
Nanocladius		1	8	
Nilotanypus	2		2	
Nilothauma	3			
Paracladopelma	11	4		
Parametriocnemus	4	1	2	7
Paratanytarsus		1	5	
Paratendipes	2			1
Phaenopsectra		1	2	2
Polypedilum fallax grp				4

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15117], Station #2, Sample Date: 3/31/2015 2:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Polypedilum flavum	162		37	3
Polypedilum halterale grp	9	30		
Polypedilum illinoense grp	9	1	25	162
Polypedilum scalaenum grp	32	13		
Rheocricotopus			4	
Rheotanytarsus	8	3	14	3
Simulium	9		28	2
Stempellinella	1	1	1	
Stictochironomus	12	53		2
Tanytarsus	61	16	42	17
Thienemanniella	2		3	
Thienemannimyia grp.	29	10	17	
Tipula	-99		-99	
Tribelos		1		
EPHEMEROPTERA				
Acerpenna	1			1
Caenis latipennis	22	6	10	1
Stenacron	1			
Stenonema femoratum	6	1		
Tricorythodes	2			1
HAPLOTAXIDA				
Haplotaxis	2			
ISOPODA				
Caecidotea	1			
LUMBRICINA				
Lumbricina	-99			
ODONATA				
Argia	2		1	
Enallagma			3	
Libellula			1	
Progomphus obscurus		1		
TRICHOPTERA				
Cheumatopsyche	6		1	
TRICLADIDA				
Planariidae	1			
TUBIFICIDA				
Branchiura sowerbyi	1	1		
Enchytraeidae	4	9	4	2
Limnodrilus claparedianus	1	1	1	
Limnodrilus hoffmeisteri	1	3	7	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15117], Station #2, Sample Date: 3/31/2015 2:15:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Tubificidae	13	6	11	
VENEROIDA				
Corbicula				1
Pisidiidae	4		2	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15116], Station #3, Sample Date: 3/31/2015 11:50:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		11	
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	
BASOMMATOPHORA			
Physella			1
COLEOPTERA			
Berosus		1	3
Dubiraphia		3	2
Peltodytes			1
Stenelmis	21	5	2
DECAPODA			
Faxonius virilis			1
DIPTERA			
Ablabesmyia		8	14
Ceratopogoninae	1	8	
Chironomidae	3	6	2
Chironomus	1	4	
Cladotanytarsus	30	25	3
Corynoneura	2	3	3
Cricotopus sylvestris grp	1		
Cricotopus/Orthocladius	75	10	20
Cryptochironomus	6	1	
Cryptotendipes		16	1
Dicrotendipes	1	3	2
Eukiefferiella	3		
Hemerodromia	1		1
Hydrobaenus	2	2	9
Labrundinia		1	
Nanocladius		3	12
Nilotanypus			3
Ormosia	5		
Paracladopelma	11		
Parametriocnemus		1	2
Paratanytarsus		3	7
Paratendipes	4	14	
Phaenopsectra	2	5	4
Polypedilum fallax grp			1
Polypedilum flavum	282	2	10
Polypedilum halterale grp	5	9	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15116], Station #3, Sample Date: 3/31/2015 11:50:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	1	4	58
Polypedilum scalaenum grp	70	5	
Rheocricotopus	2		
Rheotanytarsus	5	2	17
Simulium	30		
Stictochironomus	17	12	
Tanytarsus	25	22	50
Thienemanniella	1	1	2
Thienemannimyia grp.	10	2	16
Zavrelimyia		1	
EPHEMEROPTERA			
Acerpenna	1		
Caenis latipennis	6	16	15
Stenacron		1	
Stenonema femoratum	1	3	-99
Tricorythodes	2		
HAPLOTAXIDA			
Haplotaxis	1		
LUMBRICINA			
Lumbricina	-99	-99	
ODONATA			
Argia			3
Calopteryx			1
Enallagma		2	13
TRICHOPTERA			
Cheumatopsyche	2		
Pycnopsyche			-99
TUBIFICIDA			
Branchiura sowerbyi	1	1	
Enchytraeidae	12	7	2
Limnodrilus claparedianus	3	1	1
Limnodrilus hoffmeisteri	8	10	1
Tubificidae	36	24	
VENEROIDA			
Corbicula	-99		1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15115], Station #3.5, Sample Date: 3/31/2015 10:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		2	6
AMPHIPODA			
Hyalella azteca			-99
BASOMMATOPHORA			
Physella			-99
COLEOPTERA			
Berosus			5
Dubiraphia			8
Stenelmis	70		8
DECAPODA			
Faxonius virilis			-99
DIPTERA			
Ablabesmyia		1	21
Ceratopogoninae	3	2	4
Chironomidae	1		
Chironomus		4	1
Cladotanytarsus	20	41	6
Corynoneura	1		3
Cricotopus sylvestris grp	2		
Cricotopus/Orthocladius	122	1	34
Cryptochironomus	9		1
Cryptotendipes		34	1
Demicryptochironomus	1		
Dicrotendipes	3	4	6
Eukiefferiella	12		1
Hydrobaenus	7	7	19
Labrundinia			10
Microtendipes	2		
Nanocladius			16
Nilothauma			1
Ormosia	4		
Parachironomus			1
Paracladopelma	1	1	
Parakiefferiella		1	
Paralauterborniella		1	
Parametriocnemus	1	1	4
Paratanytarsus	1	1	12
Paratendipes	2	17	1
Phaenopsectra		3	5

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15115], Station #3.5, Sample Date: 3/31/2015 10:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum flavum	204	1	2
Polypedilum halterale grp	1	51	
Polypedilum illinoense grp		1	14
Polypedilum scalaenum grp	34	13	1
Rheotanytarsus	18		26
Simulium	21		
Stempellinella	1	4	
Stictochironomus	3	27	
Tabanus	-99		
Tanytarsus	28	36	55
Thienemanniella	1		1
Thienemannimyia grp.	8		16
Zavrelimyia	2		1
EPHEMEROPTERA			
Caenis latipennis		1	14
Stenonema femoratum	5		
Tricorythodes	1		
ISOPODA			
Caecidotea		3	
LUMBRICINA			
Lumbricina	-99		
ODONATA			
Argia			4
Enallagma			26
Gomphus			-99
Libellula		1	
Somatochlora			-99
PLECOPTERA			
Perlidae	1		
TRICHOPTERA			
Cheumatopsyche	9		3
Helicopsyche	1		
Ptilostomis			-99
Pycnopsyche			-99
TUBIFICIDA			
Branchiura sowerbyi	1		
Enchytraeidae	2	3	
Limnodrilus hoffmeisteri	13		
Limnodrilus udekemianus	1		
Tubificidae	57	8	4

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15115], Station #3.5, Sample Date: 3/31/2015 10:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
VENEROIDA			
Corbicula	2	2	
Pisidiidae		2	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15114], Station #4, Sample Date: 3/31/2015 9:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		21	
AMPHIPODA			
Crangonyx	2		
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
COLEOPTERA			
Berosus		2	6
Dubiraphia			7
Peltodytes		1	
Stenelmis	23	8	9
DECAPODA			
Faxonius virilis			-99
DIPTERA			
Ablabesmyia	2	30	5
Ceratopogoninae	1	3	1
Chironomidae	33	44	29
Cladotanytarsus	12	29	10
Corynoneura	1	1	8
Cricotopus/Orthocladius	196	40	58
Cryptochironomus	2	4	
Dicrotendipes	12	7	2
Eukiefferiella	3		
Hemerodromia	1		
Hydrobaenus	4	10	2
Labrundinia			2
Micropsectra	12		7
Microtendipes		1	
Nanocladius	5	5	10
Neozavrelia	3		
Nilotanypus			2
Nilothauma		1	
Ormosia	1		
Paraphaenocladius			1
Paratanytarsus	2		1
Paratendipes		7	3
Phaenopsectra	3	1	2
Polypedilum aviceps	2		
Polypedilum flavum	208	8	19
Polypedilum halterale grp		26	3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15114], Station #4, Sample Date: 3/31/2015 9:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	1		
Polypedilum scalaenum grp	23	21	3
Rheotanytarsus	47	1	26
Saetheria	1	3	
Simulium	16		1
Stempellinella	3	2	2
Stictochironomus	1	39	
Tabanus	-99		
Tanytarsus	34	14	23
Thienemanniella	1	1	5
Thienemannimyia grp.	5	1	5
Tipula			-99
Zavreliomyia			1
EPHEMEROPTERA			
Caenis latipennis	5	4	7
Stenacron	1		
Stenonema femoratum	2	5	
Tricorythodes	6	1	
LUMBRICULIDA			
Lumbriculidae	3	3	4
ODONATA			
Argia			1
Enallagma			5
Hagenius brevistylus			-99
Progomphus obscurus	-99		
TRICHOPTERA			
Cheumatopsyche	8	-99	1
Chimarra	1		
Hydropsyche	2		
Hydroptila	1		
Nectopsyche		1	1
Oecetis			1
TUBIFICIDA			
Branchiura sowerbyi		-99	
Enchytraeidae	5		4
Limnodrilus hoffmeisteri	2		1
Tubificidae	5	4	2
Varichaetadrilus angustipenis	3		
VENEROIDA			
Corbicula	3	2	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15114], Station #4, Sample Date: 3/31/2015 9:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Pisidiidae			1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15113], Station #5, Sample Date: 3/30/2015 4:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	4	15
ARHYNCHOBDELLIDA			
Erpobdellidae	-99	-99	
BASOMMATOPHORA			
Ancylidae	2	2	2
COLEOPTERA			
Berosus		1	2
Dubiraphia		2	2
Peltodytes			3
Stenelmis	25	6	5
DECAPODA			
Faxonius virilis			-99
DIPTERA			
Ablabesmyia	2	26	25
Ceratopogoninae		6	
Chironomidae	1	3	1
Cladotanytarsus	8	37	3
Corynoneura		2	11
Cricotopus sylvestris grp	33	3	2
Cricotopus/Orthocladius	160	8	10
Cryptochironomus	1	6	
Cryptotendipes		6	1
Dicrotendipes	10	7	1
Eukiefferiella	2		1
Forcipomyiinae			1
Hydrobaenus	4	12	10
Labrundinia			9
Microtendipes	1	1	
Nanocladius	7	2	24
Nilotanypus	1		1
Nilothauma		1	
Parachironomus			1
Paralauterborniella		2	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15113], Station #5, Sample Date: 3/30/2015 4:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Parametriocnemus	2	1	3
Paratanytarsus	2	1	5
Paratendipes		6	
Phaenopsectra		6	
Polypedilum aviceps			1
Polypedilum flavum	280	5	19
Polypedilum halterale grp	1	27	
Polypedilum illinoense grp	1	2	15
Polypedilum scalaenum grp	22	23	1
Procladius		1	
Rheocricotopus			2
Rheotanytarsus	22	4	13
Simulium	9		10
Stictochironomus	2	28	
Tanytarsus	18	30	59
Thienemanniella	2		3
Thienemannimyia grp.	15	7	13
Zavrelimyia	1		
EPHEMEROPTERA			
Caenis latipennis	6	8	10
Centroptilum			2
Stenonema femoratum	2	3	1
Tricorythodes	2		
HAPLOTAXIDA			
Haplotaxis	1		
ISOPODA			
Caecidotea		-99	1
ODONATA			
Argia	1		5
Enallagma		3	16
Epithea (Epicordulia)		-99	
Gomphus			1
Hetaerina		-99	
TRICHOPTERA			
Chimarra	1		
Helicopsyche	1		1
Hydropsyche	11		3
Triaenodes			1
TUBIFICIDA			
Enchytraeidae	3	1	1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15113], Station #5, Sample Date: 3/30/2015 4:40:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Limnodrilus hoffmeisteri		1	
Tubificidae	10	18	4
VENEROIDA			
Pisidiidae	1	3	3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15112], Station #5.5, Sample Date: 3/30/2015 3:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	6	1
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		1
BASOMMATOPHORA			
Lymnaeidae			1
COLEOPTERA			
Berosus		2	
Dubiraphia	1	5	1
Stenelmis	27	5	7
DIPTERA			
Ablabesmyia	2	21	9
Ceratopogoninae	1	5	
Chaoborus		1	
Chironomidae		7	10
Chironomus		2	
Cladotanytarsus	10	12	1
Corynoneura	1		1
Cricotopus sylvestris grp	8		1
Cricotopus/Orthocladius	105	10	32
Cryptochironomus	4	4	
Cryptotendipes		2	
Dicrotendipes	7	10	1
Ephydridae		1	
Eukiefferiella	1		
Hydrobaenus	3	10	14
Labrundinia			5
Nanocladius	2	2	13
Ormosia		3	
Paracladopelma		2	
Parametriocnemus		2	2
Paratanytarsus	2	1	7
Paratendipes	1	2	
Phaenopsectra		5	1
Polypedilum fallax grp		1	
Polypedilum flavum	264	10	28
Polypedilum halterale grp		27	
Polypedilum illinoense grp	2	5	31
Polypedilum scalaenum grp	34	6	
Procladius		1	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15112], Station #5.5, Sample Date: 3/30/2015 3:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Rheotanytarsus	2	5	2
Simulium	10		10
Stictochironomus	8	31	
Tabanus	-99		
Tanytarsus	52	20	59
Telopelopia	1		
Thienemanniella	2		2
Thienemannimyia grp.	14	5	18
Tribelos		2	
EPHEMEROPTERA			
Acerpenna	1		
Caenis latipennis	1	2	4
Stenonema femoratum	3		
HAPLOTAXIDA			
Haplotalis	1		
ODONATA			
Argia		1	
Calopteryx			1
Dromogomphus		1	
Enallagma		2	4
Macromia			1
RHYNCHOBDELLIDA			
Piscicolidae		1	
TRICHOPTERA			
Agrypnia		-99	
Cheumatopsyche	6	2	1
Hydroptila		1	1
Mystacides		1	1
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Branchiura sowerbyi		1	
Enchytraeidae	5	1	1
Limnodrilus claparedianus	2	4	
Limnodrilus hoffmeisteri	1	5	
Tubificidae	34	36	2
VENEROIDA			
Corbicula		1	
Pisidiidae			1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15111], Station #6, Sample Date: 3/30/2015 2:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	3	2
BASOMMATOPHORA			
Lymnaeidae		1	
Physella	1		1
COLEOPTERA			
Berosus		1	1
Dubiraphia	1		2
Stenelmis	29	11	8
DECAPODA			
Faxonius virilis	-99		-99
DIPTERA			
Ablabesmyia	5	6	4
Ceratopogoninae		3	1
Chironomidae	3	2	2
Chironomus		2	
Cladotanytarsus	12	28	3
Corynoneura	1	4	5
Cricotopus bicinctus	1	1	11
Cricotopus sylvestris grp	15		8
Cricotopus/Orthocladius	134	10	54
Cryptochironomus	1	2	1
Cryptotendipes		4	
Dicrotendipes	3	5	4
Diptera	1	2	
Eukiefferiella	5	1	
Hemerodromia			1
Hydrobaenus	6	8	2
Labrundinia			1
Nanocladius	1	2	10
Natarsia		1	
Nilotanypus			3
Ormosia		1	
Paracladopelma		1	1
Parametriocnemus		1	
Paratanytarsus	1	2	7
Paratendipes	1	1	
Phaenopsectra	1		1
Pilaria	1		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15111], Station #6, Sample Date: 3/30/2015 2:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum aviceps	1		2
Polypedilum flavum	231	6	99
Polypedilum halterale grp		39	
Polypedilum illinoense grp	3	1	12
Polypedilum scalaenum grp	18	6	
Rheocricotopus			1
Rheotanytarsus	14	2	19
Simulium	26		14
Stempellinella		1	
Stictochironomus		43	
Tanytarsus	32	20	64
Thienemanniella	4	2	2
Thienemannimyia grp.	15	2	13
Tipula			-99
EPHEMEROPTERA			
Acerpenna	1		
Caenis latipennis	3	1	3
Leptophlebiidae			-99
Stenacron	1	2	
Stenonema femoratum	4	5	-99
ISOPODA			
Caecidotea		1	
LUMBRICINA			
Lumbricina		1	
ODONATA			
Argia			-99
Basiaeschna janata			-99
Calopteryx			-99
Enallagma			4
Macromia			-99
TRICHOPTERA			
Cheumatopsyche	9		10
Chimarra	2		-99
Helicopsyche	4		
Hydroptila		1	1
Oecetis		1	
TUBIFICIDA			
Enchytraeidae	5	4	2
Limnodrilus claparedianus	1		
Limnodrilus hoffmeisteri	3	2	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15111], Station #6, Sample Date: 3/30/2015 2:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tubificidae	15	9	3
VENEROIDA			
Pisidiidae	1		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15110], Station #6.5, Sample Date: 3/30/2015 12:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	2	13
AMPHIPODA			
Hyalella azteca			7
BASOMMATOPHORA			
Ancylidae	1		
Lymnaeidae			1
Physella			2
COLEOPTERA			
Berosus			2
Dubiraphia		1	8
Peltodytes		3	1
Scirtidae			1
Stenelmis	112	6	8
DIPTERA			
Ablabesmyia		12	9
Ceratopogoninae		2	
Chironomidae	5		2
Chironomus		3	
Cladotanytarsus	6	33	
Clinocera	5		
Corynoneura	6	3	13
Cricotopus bicinctus	5	1	4
Cricotopus/Orthocladius	153	9	58
Cryptotendipes		10	
Dicrotendipes	4	2	4
Diptera		1	
Endochironomus			1
Eukiefferiella	6		
Hemerodromia	3	1	1
Hydrobaenus	5	23	16
Labrundinia			8
Nanocladius		4	13
Ormosia	1		
Paracladopelma		1	
Parametriocnemus	4		
Paraphaenocladius			3
Paratanytarsus	1	2	12
Paratendipes		8	
Phaenopsectra		1	11

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15110], Station #6.5, Sample Date: 3/30/2015 12:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum aviceps	5		
Polypedilum flavum	149	2	2
Polypedilum halterale grp		51	
Polypedilum illinoense grp	3	1	29
Polypedilum scalaenum grp	12	6	
Procladius			1
Pseudochironomus		1	
Rheotanytarsus	10	2	5
Simulium	39		
Stempellinella		1	
Stictochironomus	1	43	
Tabanus	-99		
Tanytarsus	19	26	40
Thienemanniella	9	1	4
Thienemannimyia grp.	9	2	10
EPHEMEROPTERA			
Acerpenna			2
Caenis latipennis	3	3	4
Centroptilum			1
Leptophlebiidae			2
Stenonema femoratum	6	2	1
ISOPODA			
Caecidotea			1
LUMBRICINA			
Lumbricina		1	
ODONATA			
Argia			1
Basiaeschna janata			1
Calopteryx			1
Enallagma			8
Gomphidae			1
Hagenius brevistylus			-99
Ischnura			1
Libellula			-99
PLECOPTERA			
Amphinemura	1		
Perlidae	2		
TRICHOPTERA			
Cheumatopsyche	10		
Helicopsyche	2	1	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15110], Station #6.5, Sample Date: 3/30/2015 12:30:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Oecetis			1
Ptilostomis			1
Pycnopsyche			2
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Branchiura sowerbyi		5	
Enchytraeidae	12	2	1
Limnodrilus claparedianus		2	
Limnodrilus hoffmeisteri	4	7	
Tubificidae	13	37	4
UNIONIDA			
Unionidae			-99
VENEROIDA			
Pisidiidae		2	3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15109], Station #7, Sample Date: 3/30/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	4	3
AMPHIPODA			
Hyalella azteca			6
ARHYNCHOBDELLIDA			
Erpobdellidae		-99	1
BASOMMATOPHORA			
Physella			1
COLEOPTERA			
Dubiraphia			9
Dytiscidae			1
Stenelmis	83	4	5
DECAPODA			
Faxonius virilis			-99
DIPTERA			
Ablabesmyia		9	17
Ceratopogoninae	2	5	1
Chaoborus		1	1
Chironomidae	2	2	4
Chrysops			1
Cladotanytarsus	12	34	1
Clinocera	5	1	
Corynoneura	4	9	5
Cricotopus bicinctus	3		
Cricotopus sylvestris grp	1		1
Cricotopus/Orthocladius	165	17	58
Cryptochironomus	4	5	
Cryptotendipes		18	2
Culex		1	
Demicryptochironomus	3		
Dicrotendipes	1	1	2
Diptera		1	
Eukiefferiella	8		1
Hemerodromia	1		
Hydrobaenus	22	17	26
Labrundinia			4
Limnophyes		1	1
Nanocladius			18
Nilotanypus	1		
Parakiefferiella			3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15109], Station #7, Sample Date: 3/30/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Paralauterborniella		1	
Parametriocnemus	2	2	2
Paratanytarsus	1		6
Paratendipes	5	5	
Phaenopsectra	2	2	1
Polypedilum aviceps	1		
Polypedilum flavum	110	2	4
Polypedilum halterale grp		22	2
Polypedilum illinoense grp	2	1	18
Polypedilum scalaenum grp	64	4	
Procladius		1	
Rheocricotopus			1
Rheotanytarsus	1		3
Simulium	73	1	10
Stenochironomus			1
Stictochironomus	8	50	1
Tabanus	3	1	
Tanytarsus	18	13	34
Thienemanniella		1	4
Thienemannimyia grp.	9		4
Tipula			1
EPHEMEROPTERA			
Caenis latipennis		1	11
Centroptilum			5
Leptophlebia		-99	
Stenacron	1		1
Stenonema femoratum	1	1	
GORDIOIDEA			
Gordiidae	-99		
ODONATA			
Basiaeschna janata			1
Enallagma		1	5
Macromia			-99
Nasiaeschna pentacantha			1
PLECOPTERA			
Perlesta	3		
TRICHOPTERA			
Cheumatopsyche	5	1	2
Chimarra	4		
Helicopsyche	1	2	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15109], Station #7, Sample Date: 3/30/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Ptilostomis			1
Pycnopsyche	-99		4
Triaenodes			1
TUBIFICIDA			
Enchytraeidae	1	1	
Limnodrilus claparedianus	1	2	
Limnodrilus hoffmeisteri	1	5	
Tubificidae	18	27	3
VENEROIDA			
Pisidiidae	1	1	1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15108], Station #8, Sample Date: 3/30/2015 9:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		2	9
AMPHIPODA			
Crangonyx			1
Hyalella azteca			7
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		1
BASOMMATOPHORA			
Ancylidae			1
Lymnaeidae			2
Physella	1		2
COLEOPTERA			
Dubiraphia		1	8
Dytiscidae			1
Helichus basalis			1
Peltodytes		1	2
Scirtidae			1
Stenelmis	44	2	1
DIPTERA			
Ablabesmyia	1	8	12
Ceratopogoninae			6
Chrysops			-99
Cladotanytarsus	5	43	3
Clinocera	2		
Corynoneura	1	8	10
Cricotopus bicinctus	3		6
Cricotopus/Orthocladius	170	11	34
Cryptochironomus	2	3	
Cryptotendipes		19	
Diamesa	4		
Dicrotendipes	2	4	9
Diplocladius	1		
Diptera	1	1	
Eukiefferiella	6		
Hydrobaenus	107	44	52
Labrundinia			1
Micropsectra	2		
Nanocladius		1	11
Paracladopelma	3		
Parametriocnemus	4		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15108], Station #8, Sample Date: 3/30/2015 9:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Paraphaenocladus		1	3
Paratanytarsus		3	40
Paratendipes	3	1	
Phaenopsectra		2	3
Polypedilum flavum	69	1	1
Polypedilum halterale grp	1	21	
Polypedilum illinoense grp	3	9	12
Polypedilum scalaenum grp	16	14	
Pseudochironomus	1	1	
Rheocricotopus	1		
Rheotanytarsus	3		2
Simulium	46		2
Stempellinella			1
Stictochironomus	25	34	1
Tabanus	-99		
Tanytarsus	48	30	52
Thienemanniella	7	1	3
Thienemannimyia grp.	17	2	3
Tipula			-99
EPHEMEROPTERA			
Acerpenna	1		
Caenis latipennis	3	1	5
Centropilum		1	1
Stenacron		1	
Stenonema femoratum	4		1
HAPLOTAXIDA			
Haplotaxis	1		
ODONATA			
Basiaeschna janata			-99
Dromogomphus		-99	
Enallagma			7
Somatochlora			-99
PLECOPTERA			
Perlesta	11		
TRICHOPTERA			
Cheumatopsyche	9		
Helicopsyche	2		
Pycnopsyche			-99
Rhyacophila	-99		
Trienodes			1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15108], Station #8, Sample Date: 3/30/2015 9:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TUBIFICIDA			
Enchytraeidae	2	2	
Limnodrilus claparedianus			1
Limnodrilus hoffmeisteri	16	1	2
Tubificidae	33	8	3
VENEROIDA			
Pisidiidae	4	1	8

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15119], Station #1a, Sample Date: 4/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	1	2
AMPHIPODA			
Crangonyx	15	5	47
BASOMMATOPHORA			
Ancylidae			1
Physella			-99
COLEOPTERA			
Dubiraphia			1
Helichus basalis			2
Stenelmis	67	4	13
DECAPODA			
Faxonius virilis			-99
DIPTERA			
Ablabesmyia		7	13
Ceratopogoninae	2	3	
Chironomus		1	
Cladotanytarsus	34	11	
Clinocera	4		
Corynoneura	4	6	5
Cricotopus/Orthocladius	406	14	87
Cryptochironomus	13	2	3
Demicryptochironomus	2	1	
Dicrotendipes	2	7	14
Eukiefferiella	10		
Glyptotendipes		1	4
Hemerodromia	2		3
Hexatoma	-99		
Hydrobaenus	15	57	14
Krenosmittia	3		
Larsia	2	1	
Microtendipes			2
Nanocladius		1	6
Nilotanypus	2		
Parametriocnemus	16		1
Paraphaenocladius	1		
Paratanytarsus			7
Paratendipes	14	39	7
Phaenopsectra		1	3
Polypedilum flavum	282		4

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15119], Station #1a, Sample Date: 4/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum halterale grp		9	
Polypedilum illinoense grp	11	4	9
Polypedilum scalaenum grp	29	8	1
Rhamphomyia		1	
Rheocricotopus	2		1
Rheotanytarsus	5		6
Simulium	6		
Stictochironomus	1		
Tabanus	-99		
Tanytarsus	50	22	50
Thienemanniella	11		2
Thienemannimyia grp.	2		14
Tipula			-99
Zavrelimyia		1	
EPHEMEROPTERA			
Caenis latipennis	3	1	7
Centroptilum			1
Stenacron		1	
Stenonema femoratum	1	2	1
ISOPODA			
Caecidotea	58	15	11
Caecidotea (Blind & Unpigmented)	1	1	
LUMBRICINA			
Lumbricina	1		1
ODONATA			
Basiaeschna janata			-99
Enallagma			7
PLECOPTERA			
Amphinemura	1		
Chloroperlidae	8		
Isoperla	14		
Perlesta	15		
RHYNCHOBDELLIDA			
Glossiphoniidae	-99		
TRICHOPTERA			
Cheumatopsyche	2		
Chimarra	2		
Pycnopsyche			-99
Triaenodes			1

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15119], Station #1a, Sample Date: 4/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Enchytraeidae	5		
Limnodrilus hoffmeisteri	2	3	1
Tubificidae	14	11	3

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15120], Station #1b, Sample Date: 4/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	3	4
AMPHIPODA			
Crangonyx	4	17	28
Hyalella azteca			1
BASOMMATOPHORA			
Menetus			1
COLEOPTERA			
Dubiraphia			1
Stenelmis	60	5	1
DIPTERA			
Ablabesmyia		15	8
Ceratopogoninae	3		2
Chironomidae	1	4	3
Cladotanytarsus	44	15	5
Corynoneura	8	2	9
Cricotopus bicinctus			1
Cricotopus sylvestris grp	2		
Cricotopus/Orthocladius	217	11	73
Cryptochironomus	6	1	
Cryptotendipes		4	
Demicryptochironomus	1		
Dicrotendipes	1	6	13
Eukiefferiella	1		
Glyptotendipes	1		2
Hemerodromia	1		1
Hexatoma	-99		
Hydrobaenus	10	41	11
Labrundinia			1
Microtendipes		1	
Nanocladius	1		4
Natarsia		2	
Nilotanypus	1		
Parametriocnemus	9	1	
Paratanytarsus			5
Paratendipes	8	77	11
Phaenopsectra		2	
Polypedilum aviceps	41	1	2
Polypedilum flavum	113		4
Polypedilum halterale grp		2	

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15120], Station #1b, Sample Date: 4/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	3	2	14
Polypedilum scalaenum grp	39	6	
Procladius		2	1
Rheocricotopus	2		1
Rheotanytarsus	3		5
Simulium	2		
Stempellinella		1	2
Stictochironomus	1	2	
Tabanus	-99		
Tanytarsus	22	21	73
Thienemanniella	8		
Thienemannimyia grp.	6	1	4
EPHEMEROPTERA			
Caenis latipennis	1		6
Stenonema femoratum	-99	8	
HAPLOTAXIDA			
Haplotaxis		2	
ISOPODA			
Caecidotea	12	3	7
LUMBRICINA			
Lumbricina	-99		
LUMBRICULIDA			
Lumbriculidae		1	
ODONATA			
Basiaeschna janata			-99
Enallagma			2
PLECOPTERA			
Amphinemura	3		
Chloroperlidae	7		
Isoperla	5		
Perlesta	5		2
Perlinella ephyre		-99	
TRICHOPTERA			
Cheumatopsyche	1		1
Chimarra	1		
Pycnopsyche			-99
TUBIFICIDA			
Branchiura sowerbyi		1	
Enchytraeidae	2		1
Limnodrilus claparedianus		3	

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15120], Station #1b, Sample Date: 4/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Limnodrilus hoffmeisteri		2	1
Limnodrilus udekemianus		1	
Tubificidae	9	26	1

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15121], Station #2, Sample Date: 4/1/2015 10:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	4	4
AMPHIPODA			
Crangonyx	1	1	4
BASOMMATOPHORA			
Physella	1		
COLEOPTERA			
Dubiraphia			1
Stenelmis	158	1	9
DECAPODA			
Faxonius virilis		-99	-99
DIPTERA			
Ablabesmyia		3	13
Ceratopogoninae		2	3
Chironomidae		5	5
Chironomus		1	2
Cladotanytarsus	3	6	3
Corynoneura	5	8	10
Cricotopus bicinctus	3		2
Cricotopus/Orthocladius	243	23	212
Cryptochironomus	5	1	1
Cryptotendipes		2	
Dicrotendipes	5	8	7
Diplocladius	1		
Eukiefferiella	5		1
Hexatoma	-99		
Hydrobaenus	5	30	13
Labrundinia			1
Nanocladius	1	2	2
Nilotanypus	1		
Nilothauma		1	1
Orthocladius (Euorthocladius)			1
Parametriocnemus	2	1	
Paraphaenocladius	1		
Paratanytarsus	1	1	4
Paratendipes	4	85	9
Phaenopsectra		1	2
Polypedilum aviceps	43		5
Polypedilum flavum	42	1	9
Polypedilum halterale grp		3	1

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15121], Station #2, Sample Date: 4/1/2015 10:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	2	3	19
Polypedilum scalaenum grp	7	4	
Procladius			1
Rheotanytarsus	1		1
Simulium	2		
Stempellinella		3	
Stictochironomus		1	
Tabanus	-99		
Tanypus		1	
Tanytarsus	43	16	36
Telopelopia	1		
Thienemanniella	3		4
Thienemannimyia grp.	8		1
Tipula			-99
EPHEMEROPTERA			
Caenis latipennis	1	2	2
Stenacron		1	
Stenonema femoratum	6	1	2
ISOPODA			
Caecidotea	6	1	
ODONATA			
Argia			1
Basiaeschna janata			-99
Enallagma			4
PLECOPTERA			
Chloroperlidae	1		
Isoperla			1
Perlesta	1		
RHYNCHOBDELLIDA			
Glossiphoniidae		-99	
TRICHOPTERA			
Chimarra	2		
Pycnopsyche			-99
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Branchiura sowerbyi		1	
Enchytraeidae	1	1	
Limnodrilus claparedianus		6	
Limnodrilus hoffmeisteri		6	

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15121], Station #2, Sample Date: 4/1/2015 10:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Limnodrilus udekemianus		1	
Tubificidae	7	57	2
VENEROIDA			
Pisidiidae	-99		1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15146], Station #1, Sample Date: 9/29/2015 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
"HYDRACARINA"				
Acarina			4	8
BASOMMATOPHORA				
Ancylidae			25	
Menetus			1	
Physella			3	
COLEOPTERA				
Berosus		1	4	
Dubiraphia			17	1
Macronychus glabratus			2	1
Scirtidae			11	1
Stenelmis	5	1	1	
DECAPODA				
Faxonius virilis		-99	-99	
Palaemonetes kadiakensis			-99	
DIPTERA				
Ablabesmyia		22	12	8
Ceratopogoninae		2		
Chironomidae	1	2		2
Chironomus		33	2	4
Cladotanytarsus	1	4		5
Corynoneura	5	9	6	3
Cricotopus bicinctus	2	1		
Cricotopus sylvestris grp		1		4
Cricotopus/Orthocladius	7			13
Cryptochironomus	2	9		
Dicrotendipes		22	7	67
Forcipomyiinae				6
Hemerodromia	6		1	
Labrundinia		2	7	
Nanocladius			3	
Nilothauma			1	
Parachironomus			1	
Parakiefferiella				1
Paralauterborniella		3	1	2
Parametriocnemus	2			
Paratanytarsus		2	6	1
Phaenopsectra			1	
Polypedilum flavum	31			
Polypedilum halterale grp	2	36		2

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15146], Station #1, Sample Date: 9/29/2015 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Polypedilum illinoense grp	13	2	7	3
Polypedilum scalaenum grp	1	18		8
Procladius		1	1	
Pseudochironomus				3
Rheocricotopus	1		2	
Rheotanytarsus	57			8
Saetheria	3			
Simulium	69			1
Stelechomyia				1
Stempellinella		8		2
Stenochironomus	1		2	18
Tanytarsus	34	88	86	109
Thienemanniella	11			1
Thienemannimyia grp.	11		4	6
Tribelos			2	5
EPHEMEROPTERA				
Acerpenna	51			4
Baetis	79			
Caenis anceps		9	3	
Caenis latipennis		18	9	3
Centroptilum		6	2	
Heptageniidae	2	1		
Stenacron	1	2	21	2
Stenonema femoratum		11	2	6
Tricorythodes	10	1		
GORDIOIDEA				
Chordodidae			-99	
HEMIPTERA				
Belostoma			-99	
Microvelia	1			
Ranatra buenoi			-99	
LUMBRICINA				
Lumbricina	-99			
MEGALOPTERA				
Corydalus	1			
Sialis				1
ODONATA				
Argia			30	
Coenagrionidae				1
Enallagma			18	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15146], Station #1, Sample Date: 9/29/2015 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Progomphus obscurus	-99			
TRICHOPTERA				
Cheumatopsyche	219	1		
Chimarra	7			
Hydropsyche	1			
Hydroptila		2		
Oecetis		1		
Triaenodes			4	
Wormaldia	2			
TRICLADIDA				
Planariidae			2	
TUBIFICIDA				
Branchiura sowerbyi	1		1	
Limnodrilus hoffmeisteri		1		
Tubificidae	3	12	3	8
VENEROIDA				
Corbicula	-99	2	-99	2
Pisidiidae			1	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15147], Station #2, Sample Date: 9/29/2015 11:15:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
"HYDRACARINA"				
Acarina		1	9	2
AMPHIPODA				
Hyalella azteca			9	
BASOMMATOPHORA				
Ancylidae	2	1	9	
BRANCHIOBDELLIDA				
Branchiobdellida	1			
COLEOPTERA				
Berosus			1	
Dubiraphia		1	15	1
Haliphus		1		
Laccophilus			1	
Macronychus glabratus				4
Peltodytes		6		
Scirtidae			5	
Stenelmis	35		1	1
DECAPODA				
Faxonius virilis	-99		2	1
Palaemonetes kadiakensis			-99	
DIPTERA				
Ablabesmyia	2	7	1	4
Anopheles		1	1	
Ceratopogoninae		6	3	1
Chironomus		2	1	
Cladotanytarsus	3	23		7
Corynoneura	9		7	
Cricotopus bicinctus	1			
Cricotopus/Orthocladius	4		1	2
Cryptochironomus	5	7		
Dicrotendipes	1	8	6	33
Forcipomyiinae	3		1	
Glyptotendipes			13	4
Goeldichironomus			1	
Hemerodromia	3			
Hexatoma		1		
Microtendipes				1
Nanocladius		1	5	
Nilotanypus	6			
Parachironomus			1	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15147], Station #2, Sample Date: 9/29/2015 11:15:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Paracladopelma		3		
Paralauterborniella		3		
Paratanytarsus			25	3
Paratendipes		1	1	
Polypedilum flavum	54		1	
Polypedilum halterale grp	7	46		
Polypedilum illinoense grp	2		14	3
Polypedilum scalaenum grp	7	41		1
Rheotanytarsus	6		12	
Saetheria	31			
Simulium	1			
Stempellinella	1	8	1	
Stenochironomus				6
Stictochironomus		17		1
Tanytarsus	63	29	58	91
Thienemanniella	5		5	
Thienemannimyia grp.	10		9	1
Tribelos			1	5
EPHEMEROPTERA				
Acerpenna	88		12	
Baetis	35			
Caenis anceps		2		
Caenis latipennis	1	14	6	10
Centroptilum		5		6
Leucrocuta		1	1	
Paraleptophlebia			2	
Procloeon		1		1
Stenacron	9	1	24	2
Stenonema femoratum	3	8	8	9
Tricorythodes	47	1		2
HEMIPTERA				
Microvelia			1	
MEGALOPTERA				
Corydalus	1			
ODONATA				
Argia	1	1	6	
Enallagma			7	
Macromia		-99		
Progomphus obscurus		-99		
TRICHOPTERA				

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15147], Station #2, Sample Date: 9/29/2015 11:15:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	CS	NF	RM	SG
Cheumatopsyche	144			1
Chimarra	8			
Hydroptila				1
Oecetis			1	
Wormaldia	5			
TUBIFICIDA				
Limnodrilus hoffmeisteri		1		
Tubificidae	15	5		
VENEROIDA				
Corbicula	17	34	-99	
Pisidiidae	11	47		5

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15148], Station #3, Sample Date: 9/29/2015 1:50:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina			3
AMPHIPODA			
Hyalella azteca			1
ARHYNCHOBDELLIDA			
Erpobdellidae		1	-99
BASOMMATOPHORA			
Ancylidae			25
Menetus			12
Physella	1		
BRANCHIOBDELLIDA			
Branchiobdellida	3		1
COLEOPTERA			
Berosus		1	3
Dubiraphia		1	12
Macronychus glabratus			3
Scirtidae	1		3
Stenelmis	30	1	12
DECAPODA			
Faxonius virilis	-99		1
DIPTERA			
Ablabesmyia		15	4
Anopheles			1
Ceratopogoninae		1	
Chironomidae	2	4	
Chironomus		13	1
Cladotanytarsus		2	
Corynoneura	12	1	4
Cricotopus/Orthocladius	5		1
Cryptochironomus	2	4	
Dicrotendipes		5	1
Ephydriidae	1		
Forcipomyiinae	1		
Hemerodromia	5	1	2
Labrundinia			7
Nilotanypus	2	1	1
Parametriocnemus	1		
Paratanytarsus		1	9
Paratendipes		3	1
Phaenopsectra		1	3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15148], Station #3, Sample Date: 9/29/2015 1:50:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum fallax grp		1	
Polypedilum flavum	70	1	1
Polypedilum halterale grp	1	16	
Polypedilum illinoense grp	5		5
Polypedilum scalaenum grp	1	20	
Procladius		1	
Rheotanytarsus	10		5
Saetheria	10	1	
Simulium	15	1	1
Stempellinella		2	1
Stenochironomus			1
Stictochironomus		9	
Tabanus	-99		
Tanytarsus	17	16	41
Thienemanniella	3		
Thienemannimyia grp.	20		13
EPHEMEROPTERA			
Acerpenna	76		11
Baetis	43		
Caenis latipennis	2	29	11
Stenacron	1	12	9
Stenonema femoratum	2	22	
Tricorythodes	20		6
HEMIPTERA			
Microvelia			1
Rhagovelia			4
LUMBRICINA			
Lumbricina		-99	
MEGALOPTERA			
Corydalus	-99		
ODONATA			
Argia	2	2	25
Basiaeschna janata			-99
Calopteryx			5
Enallagma			25
Gomphidae		-99	
Hagenius brevistylus		-99	1
Hetaerina	1		1
Nasiaeschna pentacantha			-99
Progomphus obscurus		-99	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15148], Station #3, Sample Date: 9/29/2015 1:50:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TRICHOPTERA			
Cheumatopsyche	207	3	
Chimarra	8		
TUBIFICIDA			
Branchiura sowerbyi		3	
Tubificidae	7	38	9
VENEROIDA			
Corbicula	11	17	3
Pisidiidae	1		13

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15149], Station #3.5, Sample Date: 9/29/2015 3:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1		6
AMPHIPODA			
Hyalella azteca			4
BASOMMATOPHORA			
Ancylidae	3		26
Menetus			1
Physella			3
BRANCHIOBDELLIDA			
Branchiobdellida			2
COLEOPTERA			
Berosus		1	2
Dubiraphia		1	24
Neoporus			2
Scirtidae			3
Stenelmis	55	1	4
DECAPODA			
Faxonius virilis	1		-99
DIPTERA			
Ablabesmyia	1	16	8
Anopheles			4
Chironomidae		5	
Chironomus		1	
Cladotanytarsus	2	19	
Corynoneura	2	1	2
Cricotopus sylvestris grp		1	2
Cricotopus/Orthocladius	3		
Cryptochironomus	1	5	
Dicrotendipes		10	3
Hemerodromia	3		
Labrundinia		1	8
Micropsectra	1	2	1
Nanocladius			1
Paralauterborniella		1	
Paratanytarsus		1	8
Paratendipes		1	
Polypedilum fallax grp		7	1
Polypedilum flavum	51		
Polypedilum halterale grp		28	1
Polypedilum illinoense grp	2		3

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15149], Station #3.5, Sample Date: 9/29/2015 3:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum scalaenum grp	1	25	
Procladius		1	1
Pseudochironomus		1	
Rheotanytarsus	29	1	
Saetheria	1	5	
Simulium	22		
Stempellina		1	1
Stempellinella		1	
Stictochironomus		10	
Tabanus	-99		
Tanytarsus	20	36	13
Thienemanniella		1	2
Thienemannimyia grp.	11	2	7
Tipula	-99		
EPHEMEROPTERA			
Acerpenna	22		1
Baetis	61	1	
Caenis latipennis	1	28	6
Callibaetis			7
Centroptilum			1
Stenacron	3	1	2
Stenonema femoratum	1	60	6
Tricorythodes	37		
HEMIPTERA			
Microvelia			2
LUMBRICINA			
Lumbricina	1		
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	1	2	17
Enallagma			72
Gomphidae		1	
Progomphus obscurus	1	-99	
TRICHOPTERA			
Cheumatopsyche	234		4
Chimarra	10		
Hydropsyche	5		
Oecetis	1		
TRICLADIDA			

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15149], Station #3.5, Sample Date: 9/29/2015 3:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Planariidae	22		
TUBIFICIDA			
Branchiura sowerbyi			1
Limnodrilus hoffmeisteri			1
Tubificidae	10	7	28
VENEROIDA			
Corbicula	40	21	12
Pisidiidae		1	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15150], Station #4, Sample Date: 9/29/2015 4:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	6	5	2
AMPHIPODA			
Hyalella azteca			4
BASOMMATOPHORA			
Ancyliidae	14	1	18
Menetus			4
Physella			1
COLEOPTERA			
Berosus			2
Dubiraphia		4	17
Helichus basalis			1
Helichus lithophilus			3
Stenelmis	43	4	30
DIPTERA			
Ablabesmyia	6	12	23
Anopheles			1
Chironomidae		1	1
Chironomus		15	
Chrysops	-99		
Cladotanytarsus	2	1	
Corynoneura	4	3	2
Cricotopus sylvestris grp	1		4
Cricotopus/Orthocladius	16		3
Cryptochironomus	1	3	
Dicrotendipes	2		1
Forcipomyiinae			1
Hemerodromia	1		1
Labrundinia	4	1	25
Microtendipes			1
Nanocladius			2
Nilotanypus	2		
Parakiefferiella	1		
Paratanytarsus			7
Paratendipes	1		1
Phaenopsectra	4	1	
Polypedilum flavum	28	2	
Polypedilum halterale grp	5	3	
Polypedilum illinoense grp	13		5
Polypedilum scalaenum grp	62	31	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15150], Station #4, Sample Date: 9/29/2015 4:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Procladius		2	
Rheotanytarsus	38		3
Saetheria	1	1	
Simulium	2		
Stempellinella	1		
Stictochironomus	1	2	
Tanytarsus	93	19	25
Thienemanniella	8	2	
Thienemannimyia grp.	47	1	52
Tipula	5		
EPHEMEROPTERA			
Acerpenna	8		2
Baetis	45		
Caenis latipennis	26	81	30
Callibaetis		1	2
Stenacron	21	12	3
Stenonema femoratum	11	140	8
Tricorythodes	12		9
LUMBRICINA			
Lumbricina	2		
ODONATA			
Argia	19	5	22
Calopteryx	1		2
Enallagma			57
Hagenius brevistylus			-99
TRICHOPTERA			
Cheumatopsyche	146		1
Chimarra	1		
Hydroptila	1		
Oecetis	1		
Polycentropus		1	
Triaenodes			1
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Branchiura sowerbyi	1	6	
Tubificidae	24	11	2
VENEROIDA			
Corbicula	30	9	5
Pisidiidae	-99	1	6

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15151], Station #5, Sample Date: 9/30/2015 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	1	6
AMPHIPODA			
Hyaella azteca			9
ARHYNCHOBDELLIDA			
Erpobdellidae			-99
BASOMMATOPHORA			
Ancylidae	7		16
Menetus			7
COLEOPTERA			
Dubiraphia		2	11
Dytiscidae			2
Helichus lithophilus			2
Scirtidae			11
Stenelmis	8	2	21
DECAPODA			
Faxonius virilis		-99	
DIPTERA			
Ablabesmyia		8	2
Anopheles	1		1
Cladotanytarsus		4	
Corynoneura	9	2	4
Cricotopus bicinctus	1		
Cricotopus/Orthocladius	29		2
Cryptochironomus	5	1	
Dasyheleinae	1		1
Dicrotendipes	1	3	3
Forcipomyiinae	2		
Hemerodromia	6		
Labrundinia			11
Microtendipes	1	2	1
Nanocladius			5
Nilotanypus	5		
Parametriocnemus	1		
Paratanytarsus			17
Polypedilum fallax grp			1
Polypedilum flavum	57		3
Polypedilum halterale grp		25	

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15151], Station #5, Sample Date: 9/30/2015 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp	5		4
Polypedilum scalaenum grp	9	31	1
Procladius		3	
Pseudochironomus		1	
Rheotanytarsus	28		2
Simulium	11		
Stempellinella		3	
Stictochironomus		18	
Tabanus	-99		
Tanytarsus	27	20	9
Thienemanniella	12	1	
Thienemannimyia grp.	30		15
Tribelos			9
Zavrelimyia	1		
EPHEMEROPTERA			
Acerpenna	14		
Baetis	74		1
Caenis latipennis	2	74	5
Centroptilum			1
Stenacron	5	4	2
Stenonema femoratum	3	68	4
Tricorythodes	23		2
HEMIPTERA			
Microvelia	2		
Rhagovelia	1		
ODONATA			
Argia	2	3	18
Basiaeschna janata			-99
Calopteryx		1	
Enallagma			76
Hetaerina	2		1
TRICHOPTERA			
Cheumatopsyche	227		
Chimarra	5		
Hydropsyche	8		
Hydroptila	3		
Polycentropus		1	
TRICLADIDA			
Planariidae	7		
TUBIFICIDA			

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15151], Station #5, Sample Date: 9/30/2015 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Branchiura sowerbyi	2	1	
Limnodrilus hoffmeisteri	1		
Tubificidae	7	4	
VENEROIDA			
Corbicula	8	29	1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15152], Station #5.5, Sample Date: 9/30/2015 11:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		5	
AMPHIPODA			
Hyalella azteca			5
BASOMMATOPHORA			
Ancylidae	3	4	10
Lymnaeidae			6
Menetus			2
Physella			2
COLEOPTERA			
Berosus			9
Dubiraphia		2	16
Dytiscidae		1	
Helichus basalis			1
Stenelmis	42	1	66
Tropisternus			1
DECAPODA			
Faxonius virilis	-99		
DIPTERA			
Ablabesmyia	2	5	2
Anopheles			2
Ceratopogoninae	1	3	
Chironomus		26	
Cladotanytarsus	1	15	
Corynoneura	1	1	1
Cricotopus bicinctus		1	
Cricotopus/Orthocladius	19		1
Cryptochironomus		14	1
Dicrotendipes	1	3	
Forcipomyiinae	1		1
Hemerodromia	5		
Parakiefferiella		1	
Paratanytarsus			5
Polypedilum flavum	35		9
Polypedilum halterale grp		35	
Polypedilum illinoense grp	5	1	7
Polypedilum scalaenum grp	11	8	
Procladius		3	1
Pseudochironomus		4	
Rheotanytarsus	34		2

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15152], Station #5.5, Sample Date: 9/30/2015 11:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Simulium	15		
Stempellinella		1	
Stictochironomus		17	
Tabanus	-99		
Tanytarsus	52	38	5
Thienemanniella	4	6	
Thienemannimyia grp.	41	2	7
Tipula			1
Tribelos			2
EPHEMEROPTERA			
Acerpenna	15		
Baetis	93		
Caenis latipennis	5	71	
Procloeon		2	1
Stenacron	9		5
Stenonema femoratum	7	29	5
HEMIPTERA			
Aquarius			1
Microvelia	3		7
Rhagovelia	1		
Rheumatobates	1		
ODONATA			
Argia	4	1	14
Boyeria			1
Calopteryx	-99		3
Enallagma			68
Erythemis			1
Hetaerina	1		
Progompheus obscurus	-99		
TRICHOPTERA			
Cheumatopsyche	103		40
Chimarra	3		
Helicopsyche	1		
Hydropsyche	4		1
Hydroptila	7		
TRICLADIDA			
Planariidae	1		
TUBIFICIDA			
Tubificidae	4	15	3
VENEROIDA			

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15152], Station #5.5, Sample Date: 9/30/2015 11:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Corbicula	10	34	22
Pisidiidae	1		12

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15153], Station #6, Sample Date: 9/30/2015 1:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		7	1
AMPHIPODA			
Hyalella azteca			4
BASOMMATOPHORA			
Ancylidae	3		10
Menetus			2
Physella	2		73
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Berosus			10
Dubiraphia		5	10
Helichus basalis			2
Peltodytes			2
Scirtidae			2
Stenelmis	9	3	12
DECAPODA			
Faxonius virilis	-99	-99	
DIPTERA			
Ablabesmyia		13	1
Anopheles			1
Ceratopogoninae		1	2
Chironomidae	1	3	1
Chironomus		1	
Cladotanytarsus	6	3	
Corynoneura	3		9
Cricotopus sylvestris grp	1		
Cricotopus/Orthocladius	34		4
Cryptochironomus	8	7	
Dicrotendipes	4	12	1
Forcipomyiinae	4	1	
Hemerodromia	2		
Labrundinia	1		2
Nilotanypus	3		3
Paracladopelma		1	
Parametriocnemus	1		
Paratanytarsus			6
Paratendipes		1	
Phaenopsectra	2		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15153], Station #6, Sample Date: 9/30/2015 1:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum flavum	35		1
Polypedilum halterale grp	5	19	
Polypedilum illinoense grp	2		18
Polypedilum scalaenum grp	73		3
Procladius		4	
Pseudochironomus		7	
Rheotanytarsus	43		
Saetheria	3		
Simulium	31		
Stempellinella	2		1
Stictochironomus		19	
Tabanus	-99		
Tanytarsus	135	29	13
Thienemanniella	9		2
Thienemannimyia grp.	31		10
Tipula	1		
EPHEMEROPTERA			
Acentrella	1		
Acerpenna	20		2
Baetis	54		3
Caenis anceps		13	4
Caenis latipennis	4	79	4
Centropilum		4	
Procloeon		2	
Stenacron	1		
Stenonema femoratum	3	59	
Tricorythodes	1		
HEMIPTERA			
Microvelia			1
Rheumatobates			1
MEGALOPTERA			
Corydalus	1		
ODONATA			
Argia	3	1	16
Calopteryx			2
Enallagma			36
TRICHOPTERA			
Cheumatopsyche	66		2
Chimarra	9		
Helicopsyche	1		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15153], Station #6, Sample Date: 9/30/2015 1:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hydropsyche	3		
Hydroptila	10		
Oecetis		1	
Polycentropus		1	
TUBIFICIDA			
Tubificidae	10	2	7
VENEROIDA			
Corbicula	80	55	21
Pisidiidae			7

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15154], Station #6.5, Sample Date: 9/30/2015 2:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		2	3
AMPHIPODA			
Hyalella azteca			36
ARHYNCHOBDELLIDA			
Erpobdellidae			1
BASOMMATOPHORA			
Ancylidae	2	1	
Menetus			28
Physella	1		17
COLEOPTERA			
Dubiraphia		5	61
Dytiscidae		1	3
Scirtidae			1
Stenelmis	11	1	2
DECAPODA			
Faxonius virilis	-99		-99
DIPTERA			
Ablabesmyia	1	20	2
Ceratopogoninae		1	1
Chironomidae	3		
Chironomus	1	2	
Cladotanytarsus		3	1
Corynoneura	44		4
Cricotopus/Orthocladius	3	1	
Cryptochironomus		3	
Dicrotendipes		5	2
Hemerodromia	9		
Labrundinia			1
Microtendipes		1	
Nilotanypus	4		
Paracladopelma		1	
Paratanytarsus		1	4
Paratendipes		1	
Polypedilum aviceps	1		
Polypedilum fallax grp	1		
Polypedilum flavum	31		
Polypedilum halterale grp	1	7	
Polypedilum illinoense grp	3		1
Polypedilum scalaenum grp	16		

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15154], Station #6.5, Sample Date: 9/30/2015 2:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Procladius		11	
Pseudochironomus		1	
Rheotanytarsus	24		
Simulium	36		
Stempellinella	2	8	
Stictochironomus		12	
Tanytarsus	42	17	2
Thienemanniella	7		
Thienemannimyia grp.	45	1	5
Tipula	4		
Tribelos			11
Zavrelimyia	1		
EPHEMEROPTERA			
Acerpenna	23		
Baetis	48		
Caenis latipennis	2	110	2
Callibaetis			1
Centropilum		21	
Leptophlebiidae			3
Procloeon			-99
Stenacron	4	2	
Stenonema femoratum	4	23	2
HEMIPTERA			
Mesovelgia	9		
Pentacora	1		
Rhagovelia	26		
ODONATA			
Argia	3		3
Enallagma			40
TRICHOPTERA			
Cheumatopsyche	159		
Chimarra	49		1
Helicopsyche	8		2
Hydropsyche	6		
Triaenodes			11
TUBIFICIDA			
Aulodrilus		2	
Branchiura sowerbyi			1
Enchytraeidae	1		
Tubificidae	10	4	1

Aquid Invertebrate Database Bench Sheet Report

Hinkson Cr [15154], Station #6.5, Sample Date: 9/30/2015 2:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
VENEROIDA			
Corbicula		8	4
Pisidiidae		8	4

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15155], Station #1, Sample Date: 10/1/2015 9:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	13	
AMPHIPODA			
Crangonyx	1	1	1
Hyalella azteca			133
ARHYNCHOBDELLIDA			
Erpobdellidae		2	
BASOMMATOPHORA			
Ancylidae			1
Menetus			5
Physella			1
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia			4
Dytiscidae			1
Helichus basalis			1
Scirtidae			7
Stenelmis	36	10	
DECAPODA			
Faxonius virilis	-99	-99	-99
DIPTERA			
Ablabesmyia		7	
Anopheles	1		3
Ceratopogoninae	6		
Chironomidae	6	2	4
Chironomus		1	
Corynoneura	13		2
Cricotopus/Orthocladius	9		
Cryptochironomus		1	
Dicrotendipes		1	1
Forcipomyiinae			1
Glyptotendipes			8
Hemerodromia	2		2
Hexatoma	4		
Microtendipes	11	4	
Nanocladius			1
Nilotanytus	8		
Parakiefferiella			2
Parametriocnemus	16		1

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15155], Station #1, Sample Date: 10/1/2015 9:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Paratanytarsus		2	29
Paratendipes	1	31	1
Pentaneura	1		
Phaenopsectra		1	
Polypedilum fallax grp		1	
Polypedilum flavum	23		
Polypedilum halterale grp		1	
Polypedilum illinoense grp	7		3
Polypedilum scalaenum grp	4	19	
Procladius		1	
Rheotanytarsus	20		2
Simulium	10		
Stempellinella	3		
Stenochironomus			1
Tabanus	-99		
Tanytarsus	17	23	7
Thienemanniella	6		
Thienemannimyia grp.	33		6
EPHEMEROPTERA			
Acerpenna	47		1
Baetis	36		1
Caenis anceps		12	6
Caenis latipennis	5	46	33
Callibaetis			7
Paraleptophlebia			2
Stenacron	14	7	9
Stenonema femoratum	15	46	14
Tricorythodes			1
HEMIPTERA			
Microvelia	2		1
ISOPODA			
Caecidotea	1		5
LUMBRICINA			
Lumbricina		1	
ODONATA			
Argia		1	4
Enallagma			12
Gomphidae	1		
Ischnura			2
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15155], Station #1, Sample Date: 10/1/2015 9:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	296		4
Chimarra	40		2
Polycentropus		1	
Triaenodes			4
TRICLADIDA			
Planariidae	1		
TUBIFICIDA			
Branchiura sowerbyi		4	
Tubificidae	4	72	
VENEROIDA			
Pisidiidae		1	

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15156], Station #2, Sample Date: 10/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	6	
AMPHIPODA			
Crangonyx		3	-99
Gammarus			1
Hyaella azteca			34
BASOMMATOPHORA			
Ancylidae			14
Helisoma			19
Physella	1		1
BRANCHIOBDELLIDA			
Branchiobdellida			2
COLEOPTERA			
Dubiraphia		1	14
Dytiscidae		1	1
Scirtidae			7
Stenelmis	39	2	3
DECAPODA			
Faxonius virilis	-99	1	-99
DIPTERA			
Ablabesmyia	2	7	3
Anopheles			4
Ceratopogoninae			1
Chaoborus		1	
Chironomus		6	1
Cladotanytarsus		2	
Corynoneura			15
Cricotopus/Orthocladius	6		4
Cryptochironomus	1	5	
Dicrotendipes		2	5
Glyptotendipes			5
Hemerodromia	5		
Hexatoma	4		
Krenosmittia	1		
Labrundinia			4
Microtendipes	3	3	1
Nilotanypus	7		
Paralauterborniella		1	
Parametriocnemus	6		
Paratanytarsus		1	34

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15156], Station #2, Sample Date: 10/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Paratendipes		47	7
Pentaneura	7		
Phaenopsectra		3	3
Polypedilum fallax grp			4
Polypedilum flavum	26		1
Polypedilum halterale grp		1	
Polypedilum illinoense grp			8
Polypedilum scalaenum grp	11		3
Procladius	1	3	
Rheotanytarsus	37		2
Simulium	13		
Stempellinella	3		
Stictochironomus		8	
Tabanus	-99		
Tanytarsus	51	11	36
Thienemanniella	3		2
Thienemannimyia grp.	38		14
Tipula	2		
Tribelos	2		
Zavrelimyia			1
EPHEMEROPTERA			
Acerpenna	37		
Baetis	68		
Caenis latipennis		61	7
Hexagenia limbata		1	
Procloeon		1	4
Stenacron	10	16	1
Stenonema femoratum	2	77	5
HEMIPTERA			
Belostoma			1
Ranatra fusca			-99
Rhagovelia	1		
ISOPODA			
Caecidotea	2		2
MEGALOPTERA			
Corydalus	-99		
ODONATA			
Calopteryx			1
Enallagma			27
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report

Bonne Femme Cr [15156], Station #2, Sample Date: 10/1/2015 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	146		
Chimarra	67		
Triaenodes			4
TUBIFICIDA			
Tubificidae	10	44	4
VENEROIDA			
Corbicula			4

Appendix B

Hinkson Creek and Bonne Femme Creek Water Quality Parameter Values

Spring 2015 & Fall 2015

Physicochemical Variables at Hinkson Creek and Bonne Femme Creek Stations, Spring 2015

	HC 8	HC 7	HC 6.5	HC 6	HC 5.5	HC 5	HC 4	HC 3.5	HC 3	HC 2	HC 1	BFC 1	BFC 1 (dup)
Invertebrate Sample Number	15108	15109	15110	15111	15112	15113	15114	15115	15116	15117	15118	15119	15120
Water Chemistry Sample Number	151865	151864	151863	151862	151861	151860	151859	151858	151857	151856	151855	151866	151867
Sample Date	3/30/15	3/30/15	3/30/15	3/30/15	3/30/15	3/30/15	3/31/15	3/31/15	3/31/15	3/31/15	3/31/15	4/1/15	4/1/15
Sample Time	0915	1025	1155	1350	1510	1640	0905	1015	1135	1325	1500	0910	0915
Flow (cfs)	12.5	13.2	17.1	18.2	17.7	22.4	27.7	27.8	31.8	28.5	33.4	5.7	6.1
Temperature (°C)	6.6	7.4	8.5	12.2	13.4	14.1	9.8	10.7	11.9	13.7	14.8	11.0	11.0
Dissolved Oxygen	11.47	12.40	13.44	14.05	14.83	15.15	11.15	11.02	10.72	11.42	11.80	9.63	9.77
Conductivity (µS/cm)	373	410	466	492	512	534	588	586	616	606	603	450	452
pH (standard units)	8.2	8.0	8.5	8.5	8.8	8.8	7.9	8.1	8.1	8.1	8.1	7.7	7.7
Turbidity (NTU)	16.6	18.5	16.1	13.4	12.2	10.6	8.87	8.45	7.58	8.94	12.5	2.64	2.08
Ammonia	<0.03 ^a	<0.03 ^a	<0.03 ^a	0.034 ^b	<0.03 ^a	0.037 ^b	<0.03 ^a	0.032 ^b	<0.03 ^a	0.039 ^b	0.042 ^b	0.035 ^b	0.031 ^b
Nitrite+Nitrate	0.21	0.17	0.099	0.061	0.0097 ^b	<0.008 ^a	<0.008 ^a	<0.008 ^a	0.0087 ^b	<0.008 ^a	0.016	0.026	0.028
Total Nitrogen	0.72	0.67	0.58	0.55	0.49	0.54	0.42	0.39	0.41	0.41	0.43	0.27	0.27
Total Phosphorus	0.072	0.055	0.051	0.048	0.046	0.042	0.046	0.031 ^b	0.032 ^b	0.035 ^b	0.043	0.035 ^b	0.029 ^b
Chloride	12.1	12.8	18.0	24.8	31.1	35.9	43.2	45.7	56.6	56.9	54.2	23.4	23.0
Calcium	46.2	53.1	61.3	66.2	67.3	69.9	73.9	75.2	76.1	77.9	79.0	65.8	65.7
Magnesium	7.58	8.32	9.37	10.2	10.0	10.4	10.6	10.2	10.6	10.8	10.9	6.83	6.84
Hardness	147	167	192	207	209	217	228	231	234	239	242	192	192
Sulfate	64.4	77.8	89.7 ^c	91.2 ^c	92.3 ^c	94.9 ^c	94.8 ^c	94.4 ^c	90.3 ^c	96.3	88.7	16.7	16.1
TSS	8.00	9.00	9.00	13.0	10.0	9.00	5.00	<5.00 ^a	<5.00 ^a	6.00	8.00	<5.00 ^a	<5.00 ^a

^aBelow detectable limits

^bEstimated value, detected below Practical Quantitation Limits

^cSample was diluted during analysis

Physicochemical Variables at HC and BFC Stations, Fall 2015

	HC 8	HC 7	HC 6.5	HC 6	HC 5.5	HC 5	HC 4	HC 3.5	HC 3	HC 2	HC 1	BFC 1	BFC 1 (dup)
Invertebrate Sample Number	Not sampled due to low flow conditions.		15154	15153	15152	15151	15150	15149	15148	15147	15146	15155	N/A
Water Chemistry Sample Number			153666	153665	153664	153663	153662	153661	153660	153659	153658	153669	153670
Sample Date			9/30/15	153665	153664	9/30/15	9/29/15	9/29/15	9/29/15	9/29/15	9/29/15	10/1/15	10/1/15
Sample Time			1425	1250	1048	0910	1555	1445	1330	1106	0925	0930	0935
Flow (cfs)			0.2	0.6	1.0	1.1	0.7	0.9	0.8	1.0	1.4	0.1	0.1
Temperature (°C)			22.1	19.4	20.5	17.8	23.6	22.7	23.7	19.6	19.7	14.9	14.9
Dissolved Oxygen			8.12	9.23	7.66	7.72	9.95	8.36	8.35	4.93	6.76	6.9	6.8
Conductivity (µS/cm)			847	860	677	825	750	741	756	755	713	478	477
pH (standard units)			8.0	8.2	8.0	8.2	8.1	8.0	7.9	7.6	7.7	7.7	7.9
Turbidity (NTU)			3.4	2.1	5.1	2.9	2.9	2.6	3.1	7.3	6.4	5.2	4.1
Ammonia			0.042 ^b	0.068	0.062	0.040 ^b	<0.03 ^a	0.037 ^b	0.050 ^d	0.085	0.049 ^b	0.036 ^b	<0.03 ^a
Nitrite+Nitrate			<0.008 ^a	<0.008 ^a	0.11	0.0095 ^b	<0.008 ^a	<0.008	0.011	0.038	0.029	0.083	0.081
Total Nitrogen			0.36	0.34	0.60	0.30	0.27	0.27	0.27	0.36	0.36	0.41	0.35
Total Phosphorus			0.036 ^b	0.027 ^b	0.051	0.045	0.037 ^b	0.022 ^b	0.025 ^b	0.042 ^b	0.042 ^b	0.056	0.049 ^b
Chloride			39.6	57.3	50.6	63.4	56.7	49.4	98.2	53.1	38.7	11.3	10.2
Calcium			119 ^c	102 ^c	72.6 ^c	95.5 ^c	92.8 ^c	101 ^c	98.2 ^c	104 ^c	99.0 ^c	87.8 ^c	84.2 ^c
Magnesium			16.4 ^c	17.5 ^c	15.2 ^c	15.4 ^c	13.9 ^c	11.1 ^c	12.5 ^c	13.1 ^c	13.1 ^c	9.28 ^c	8.82 ^c
Hardness			365	327	244	302	289	298	297	314	301	257	247
Sulfate			189 ^c	179 ^c	93.9	139 ^c	112 ^c	77.1	74.7	68.4	56.1	8.46	9.62
TSS			<5.00 ^a	<5.00 ^a	6.00	<5.00 ^a	<5.00 ^a	<5.00 ^a	<5.00 ^a	6.00	6.00	<5.00 ^a	5.00

^aBelow detectable limits

^bEstimated value, detected below Practical Quantitation Limits

^cSample was diluted during analysis

^dEstimated value, matrix interference

Appendix C

Biological Metric Values Fall 2001 – Fall 2015

Taxa Richness

EPTT Taxa

Biotic Index

Shannon Diversity Index

(Shaded cells indicate values that are less than the fully supporting threshold)

Hinkson Creek Stations

HC 8 – Rogers Road

HC 7 – Hinkson Creek Road

HC 6.5 – Highway 63 Connector

HC 6 – East Walnut Street

HC 5.5 – Broadway

HC 5 – Upstream of Grindstone Creek

HC 4 – Downstream of Grindstone Creek

HC 3.5 – Recreation Drive

HC 3 – Forum Boulevard

HC 2 – Twin Lakes Recreation Area

HC 1 – Scott Boulevard

	Taxa Richness (Fully Supporting Values: Fall >73; Spring >71)														
		Fall Samples						Spring Samples							
Station	Land use segment	2001	2003	2005	2012	2014	2015	2002	2004	2005	2006	2012	2013	2014	2015
HC 8	Rural	63				93		78				77	66	78	74
HC 7	Rural	63	85	78		97		81	81	70		72	77	67	76
HC 6.5	Rural					89	70		79			81	83	85	80
HC 6	Urban	68	81	78	60	87	75	62	67	76		72	75	69	70
HC 5.5	Urban		72	69	76	90	69		81	76		75	77	87	66
HC 5	Urban	64			59	83	69	58				73	82	69	65
HC 4	Urban	76			63	77	68	73				74	79	75	69
HC 3.5	Urban			72	64	88	72			69		67	81	77	69
HC 3	Urban	90			71	72	73	70			73		67	65	62
HC 2	Urban	79			77	88	73	70			69		83	64	63
HC 1	Urban	65			67	81	77	66			75		66		63

	EPT Taxa (Fully Supporting Values: Fall >15; Spring >17)														
		Fall Samples						Spring Samples							
Station	Land use segment	2001	2003	2005	2012	2014	2015	2002	2004	2005	2006	2012	2013	2014	2015
HC 8	Rural	10				17		15				15	12	13	11
HC 7	Rural	9	18	16		16		17	16	14		10	13	10	12
HC 6.5	Rural					19	14		12			12	13	14	12
HC 6	Urban	9	13	11	10	18	17	7	9	13		12	9	13	10
HC 5.5	Urban		9	10	14	17	11		12	10		10	12	17	7
HC 5	Urban	13			3	16	12	7				10	12	8	8
HC 4	Urban	10			11	15	13	8				10	11	10	10
HC 3.5	Urban			9	13	10	12			8		9	13	9	8
HC 3	Urban	12			12	13	8	7			10		7	5	7
HC 2	Urban	8			13	13	15	7			6		4	5	6
HC 1	Urban	13			11	11	16	10			7		7		6

	Biotic Index (Fully Supporting Values: Fall <6.8; Spring <6.4)														
		Fall Samples						Spring Samples							
Station	Land use segment	2001	2003	2005	2012	2014	2015	2002	2004	2005	2006	2012	2013	2014	2015
HC 8	Rural	7.3				6.5		6.9				6.2	6.4	6.6	7.0
HC 7	Rural	7.3	7.2	7.1		6.1		6.8	7.3	5.9		6.4	6.9	6.6	6.5
HC 6.5	Rural					6.4	6.5		6.9			6.7	6.8	6.5	6.5
HC 6	Urban	7.2	7.4	7.0	7.4	6.2	6.9	7.1	7.2	5.9		6.4	7.2	7.0	6.3
HC 5.5	Urban		7.1	7.3	8.0	6.8	6.7		6.9	6.6		6.9	7.1	6.8	6.6
HC 5	Urban	6.6			7.4	6.6	6.8	7.0				6.9	6.9	6.6	6.5
HC 4	Urban	6.7			7.5	6.5	7.0	7.1				6.7	7.0	6.6	6.4
HC 3.5	Urban			7.5	7.2	6.9	6.7			7.0		7.3	7.0	6.4	6.5
HC 3	Urban	6.9			7.5	6.9	6.6	7.3			7.1		7.4	7.0	6.6
HC 2	Urban	7.0			7.3	6.9	6.5	7.2			7.3		8.0	7.1	6.6
HC 1	Urban	6.7			7.0	7.8	6.6	7.2			7.3		6.9		6.9

	Shannon Diversity Index (Fully Supporting Values: Fall >3.18; Spring >2.80)														
		Fall Samples						Spring Samples							
Station	Land use segment	2001	2003	2005	2012	2014	2015	2002	2004	2005	2006	2012	2013	2014	2015
HC 8	Rural	2.68				3.16		2.89				3.04	3.23	2.92	3.14
HC 7	Rural	2.58	3.26	3.29		3.20		2.93	3.06	2.99		3.09	3.23	2.90	3.18
HC 6.5	Rural					3.14	3.48		3.26			3.30	3.04	2.70	3.27
HC 6	Urban	2.97	3.26	3.32	2.51	3.38	3.41	2.59	3.10	2.84		2.75	3.18	2.85	2.88
HC 5.5	Urban		3.31	2.88	3.19	3.32	3.37		3.40	2.82		3.05	3.10	2.86	2.93
HC 5	Urban	3.44			3.01	3.33	3.36	2.63				3.36	3.07	3.06	3.07
HC 4	Urban	3.20			2.58	3.43	3.26	2.61				3.34	2.84	3.42	2.96
HC 3.5	Urban			2.91	2.90	3.12	3.35			2.98		3.21	2.95	3.29	3.19
HC 3	Urban	3.38			2.82	3.28	3.37	3.20			3.00		2.80	3.00	3.09
HC 2	Urban	3.19			3.05	3.40	3.46	3.16			3.22		3.12	2.96	3.22
HC 1	Urban	3.17			3.38	2.87	3.27	2.97			3.27		2.82		3.22

Appendix D

SigmaStat® Statistical Analysis Results of Hinkson Creek Mean Biological Metric
Values Comparing Pre-CAM (2001-2006) Sample Data with CAM Project Data
(2012-2015)

Combined Sample Seasons

Rural Taxa Richness

t-test

Thursday, November 30, 2017, 3:07:49 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.521)

Equal Variance Test: Passed (P = 0.215)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Rural TR (comb.)	9	2	78.571	4.577	1.730
New Rural TR (comb.)	18	2	79.063	8.805	2.201

Difference -0.491

t = -0.138 with 21 degrees of freedom. (P = 0.891)

95 percent confidence interval for difference of means: -7.873 to 6.891

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.891).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Rural EPT Taxa Richness

t-test

Thursday, November 30, 2017, 3:11:57 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.448)

Equal Variance Test: Passed (P = 0.817)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Rural EPT (comb.)	9	2	15.429	1.988	0.751
New Rural EPT (comb.)	18	2	13.313	2.469	0.617

Difference 2.116

t = 1.994 with 21 degrees of freedom. (P = 0.059)

95 percent confidence interval for difference of means: -0.0907 to 4.323

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.059).

Power of performed test with alpha = 0.050: 0.363

The power of the performed test (0.363) is below the desired power of 0.800. Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Rural Biotic Index

t-test

Monday, December 04, 2017, 11:11:19 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Monday, December 04, 2017, 11:11:19 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Group	N	Missing	Median	25%	75%
Old rural BI (comb.)	9	2	6.900	6.800	7.175
New rural BI (comb.)	18	2	6.500	6.400	6.650

Mann-Whitney U Statistic= 22.500

T = 117.500 n(small)= 7 n(big)= 16 (P = 0.026)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.026).

Rural Shannon Diversity Index

t-test

Monday, December 04, 2017, 11:13:30 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.843)

Equal Variance Test: Passed (P = 0.376)

Group Name	N	Missing	Mean	Std Dev	SEM
Old rural SDI (comb.)	9	2	3.097	0.170	0.0644
New rural SDI (comb.)	18	2	3.132	0.168	0.0420

Difference -0.0354

t = -0.463 with 21 degrees of freedom. (P = 0.648)

95 percent confidence interval for difference of means: -0.194 to 0.123

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.648).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban Taxa Richness

t-test

Wednesday, December 19, 2018, 9:06:40 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.069)

Equal Variance Test: Passed (P = 0.273)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Urban TR (comb.)	22	2	73.100	6.240	1.395
New Urban TR (comb.)	46	2	73.773	7.569	1.141

Difference -0.673

t = -0.347 with 62 degrees of freedom. (P = 0.730)

95 percent confidence interval for difference of means: -4.548 to 3.202

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.730).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban EPT Taxa Richness

t-test

Wednesday, December 19, 2018, 10:09:15 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.118)

Equal Variance Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, December 19, 2018, 10:09:15 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Group	N	Missing	Median	25%	75%
Old Urban EPT (comb.)	22	2	9.000	8.000	11.500
New Urban EPT (comb.)	46	2	10.000	8.000	13.000

Mann-Whitney U Statistic= 523.500

T = 566.500 n(small)= 20 n(big)= 44 (P = 0.227)

The difference in the median values between the two groups is not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.227)

Urban Biotic Index

t-test

Monday, December 04, 2017, 11:23:19 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Monday, December 04, 2017, 11:23:19 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Group	N	Missing	Median	25%	75%
Old Urban BI (comb.)	22	2	7.100	6.900	7.250
New Urban BI (comb.)	46	2	6.800	6.600	7.000

Mann-Whitney U Statistic= 220.500

T = 869.500 n(small)= 20 n(big)= 44 (P = 0.001)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.001)

Urban Shannon Diversity Index

t-test

Wednesday, December 19, 2018, 10:13:47 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.141)

Equal Variance Test: Passed (P = 0.673)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Urban SDI (comb.)	22	2	3.100	0.209	0.0467
New Urban SDI (comb.)	46	2	3.149	0.208	0.0314

Difference -0.0488

t = -0.868 with 62 degrees of freedom. (P = 0.389)

95 percent confidence interval for difference of means: -0.161 to 0.0636

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.389).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously

Spring Sample Season

Rural Taxa Richness

t-test

Thursday, November 30, 2017, 3:31:31 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.139)

Equal Variance Test: Passed (P = 0.707)

Group Name	N	Missing	Mean	Std Dev	SEM
Old RuralTR (spring)	7	2	77.800	4.550	2.035
New Rural TR (spring)	14	2	76.333	5.852	1.689

Difference 1.467

t = 0.498 with 15 degrees of freedom. (P = 0.626)

95 percent confidence interval for difference of means: -4.813 to 7.746

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.626).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Rural EPT Taxa Richness

t-test

Thursday, November 30, 2017, 3:34:08 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.424)

Equal Variance Test: Passed (P = 0.262)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Rural EPT (spring)	7	2	14.800	1.924	0.860
New Rural EPT (spring)	14	2	12.250	1.485	0.429

Difference 2.550

t = 2.969 with 15 degrees of freedom. (P = 0.010)

95 percent confidence interval for difference of means: 0.719 to 4.381

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.010).

Power of performed test with alpha = 0.050: 0.752

Rural Biotic Index

t-test

Monday, December 04, 2017, 11:28:23 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.281)

Equal Variance Test: Passed (P = 0.166)

Group Name	N	Missing	Mean	Std Dev	SEM
Old rural BI (spring)	7	2	6.746	0.505	0.226
New rural BI (spring)	14	2	6.592	0.227	0.0657

Difference 0.154

t = 0.891 with 15 degrees of freedom. (P = 0.387)

95 percent confidence interval for difference of means: -0.215 to 0.524

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.387).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Rural Shannon Diversity Index

t-test

Monday, December 04, 2017, 1:37:29 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.822)

Equal Variance Test: Passed (P = 0.831)

Group Name	N	Missing	Mean	Std Dev	SEM
Old rural SDI (spring)	7	2	3.026	0.146	0.0652
New rural SDI(spring)	14	2	3.087	0.178	0.0514

Difference -0.0607

t = -0.671 with 15 degrees of freedom. (P = 0.513)

95 percent confidence interval for difference of means: -0.253 to 0.132

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.513).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban Taxa Richness

t-test

Thursday, November 30, 2017, 3:36:27 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.077)

Equal Variance Test: Passed (P = 0.138)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Urban TR (spring)	14	2	72.083	4.379	1.264
New Urban TR (spring)	30	2	71.571	6.774	1.280

Difference 0.512

t = 0.240 with 38 degrees of freedom. (P = 0.811)

95 percent confidence interval for difference of means: -3.802 to 4.826

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.811).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban EPT Taxa Richness

t-test

Thursday, November 30, 2017, 3:41:42 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.158)

Equal Variance Test: Passed (P = 0.381)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Urban EPT (spring)	14	2	8.917	2.151	0.621
New Urban EPT (spring)	30	2	9.107	2.897	0.548

Difference -0.190

t = -0.204 with 38 degrees of freedom. (P = 0.839)

95 percent confidence interval for difference of means: -2.078 to 1.697

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.839).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban Biotic Index

t-test

Monday, December 04, 2017, 1:41:27 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.063)

Equal Variance Test: Passed (P = 0.600)

Group Name	N	Missing	Mean	Std Dev	SEM
Old urban BI (spring)	14	2	7.023	0.394	0.114
New urban BI (spring)	30	2	6.843	0.369	0.0697

Difference 0.180

t = 1.391 with 38 degrees of freedom. (P = 0.172)

95 percent confidence interval for difference of means: -0.0822 to 0.443

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.172).

Power of performed test with alpha = 0.050: 0.146

The power of the performed test (0.146) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban Shannon Diversity Index

t-test

Monday, December 04, 2017, 1:43:31 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.820)

Equal Variance Test: Passed (P = 0.471)

Group Name	N	Missing	Mean	Std Dev	SEM
Old urban SDI (spring)	14	2	3.048	0.222	0.0640
New urban SDI (spring)	30	2	3.058	0.185	0.0349

Difference -0.0104

t = -0.153 with 38 degrees of freedom. (P = 0.879)

95 percent confidence interval for difference of means: -0.147 to 0.127

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.879).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Fall Sample Season

Rural Taxa Richness

t-test

Saturday, December 02, 2017, 8:53:54 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.363)

Equal Variance Test: Passed (P = 0.564)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Rural TR (fall)	4	2	81.500	4.950	3.500
New Rural TR (fall)	6	2	87.250	11.955	5.977

Difference -5.750

t = -0.624 with 4 degrees of freedom. (P = 0.567)

95 percent confidence interval for difference of means: -31.345 to 19.845

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.567).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Rural EPT Taxa Richness

t-test

Saturday, December 02, 2017, 8:55:33 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.770)

Equal Variance Test: Passed (P = 0.595)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Rural EPT (fall)	4	2	17.000	1.414	1.000
New Rural EPT (fall)	6	2	16.500	2.082	1.041

Difference 0.500

t = 0.298 with 4 degrees of freedom. (P = 0.780)

95 percent confidence interval for difference of means: -4.156 to 5.156

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.780).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800. Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Rural Biotic Index

t-test

Monday, December 04, 2017, 1:47:05 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.329)

Equal Variance Test: Passed (P = 0.492)

Group Name	N	Missing	Mean	Std Dev	SEM
Old rural BI (fall)	4	2	7.160	0.0566	0.0400
New rural BI (fall)	6	2	6.375	0.189	0.0946

Difference 0.785

t = 5.449 with 4 degrees of freedom. (P = 0.006)

95 percent confidence interval for difference of means: 0.385 to 1.185

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.006).

Power of performed test with alpha = 0.050: 0.976

Rural Shannon Diversity Index

t-test

Monday, December 04, 2017, 1:56:14 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.124)

Equal Variance Test: Passed (P = 0.523)

Group Name	N	Missing	Mean	Std Dev	SEM
Old rural SDI (fall)	4	2	3.275	0.0212	0.0150
New rural SDI (fall)	6	2	3.253	0.153	0.0763

Difference 0.0225

t = 0.196 with 4 degrees of freedom. (P = 0.854)

95 percent confidence interval for difference of means: -0.296 to 0.341

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.854).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban Taxa Richness

t-test

Wednesday, December 19, 2018, 10:22:11 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.255)

Equal Variance Test: Passed (P = 0.946)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Urban TR (fall)	10	2	75.625	8.017	2.834
New Urban TR (fall)	18	2	77.625	7.535	1.884

Difference -2.000

t = -0.600 with 22 degrees of freedom. (P = 0.554)

95 percent confidence interval for difference of means: -8.907 to 4.907

The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups (P = 0.554).

Power of performed test with alpha = 0.050: 0.050

The power of the performed test (0.050) is below the desired power of 0.800.

Less than desired power indicates you are less likely to detect a difference when one actually exists. Negative results should be interpreted cautiously.

Urban EPT Taxa Richness

t-test

Wednesday, December 19, 2018, 10:24:45 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.310)

Equal Variance Test: Passed (P = 0.383)

Group Name	N	Missing	Mean	Std Dev	SEM
Old Urban EPT (fall)	10	2	10.500	2.000	0.707
New Urban EPT (fall)	18	2	13.563	2.851	0.713

Difference -3.063

t = -2.709 with 22 degrees of freedom. (P = 0.013)

95 percent confidence interval for difference of means: -5.407 to -0.718

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.013).

Power of performed test with alpha = 0.050: 0.676

Urban Biotic Index

t-test

Monday, December 04, 2017, 1:59:33 PM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Passed (P = 0.090)

Equal Variance Test: Passed (P = 0.885)

Group Name	N	Missing	Mean	Std Dev	SEM
Old urban BI (fall)	10	2	7.098	0.256	0.0904
New urban BI (fall)	18	2	6.762	0.340	0.0851

Difference 0.335

t = 2.449 with 22 degrees of freedom. (P = 0.023)

95 percent confidence interval for difference of means: 0.0513 to 0.619

The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups (P = 0.023).

Power of performed test with alpha = 0.050: 0.566

Urban Shannon Diversity Index

t-test

Wednesday, December 19, 2018, 10:28:29 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Normality Test: Failed (P < 0.050)

Test execution ended by user request, Rank Sum Test begun

Mann-Whitney Rank Sum Test

Wednesday, December 19, 2018, 10:28:29 AM

Data source: Biol_Metrics in Metrics_Stats.SNB

Group	N	Missing	Median	25%	75%
Old Urban SDI (fall)	10	2	3.225	3.070	3.315
New Urban SDI (fall)	18	2	3.355	3.275	3.390

Mann-Whitney U Statistic= 97.500

T = 66.500 n(small)= 8 n(big)= 16 (P = 0.043)

The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.043)